भारत जर्मन परियोजना .
(एन सी.ई आर टी—जी टी जेड)

मध्य प्रदेश और उत्तर प्रदेश के प्राथमिक और
मिडिल विद्यालयों में समुन्नत विज्ञान शिक्षा

पर्यावरणीय अध्ययन-विज्ञान
पर
शिक्षक पुस्तिका
कक्षा 5

आर.एस. रस्तोगी
एस.एस श्रीवास्तव
एस.के श्रीवास्तव
वी.एस कटियार
बी.बी विश्वकर्मा
एच के.एल शाह

जे सी. मिश्रा
एस वी. गुप्ता
वाई एस. डण्डौतिया
जी आर सरवईकर
एच ओ गुप्ता

बी.के. शर्मा
(शैक्षिक दल समन्वयक)
कर्मशाला विभाग

राष्ट्रीय शैक्षिक अनुसंधान और प्रशिक्षण परिषद्
NATIONAL COUNCIL OF EDUCATIONAL RESEARCH AND TRAINING

प्राक्कथन

कक्षा 5 के लिए शिक्षक पुस्तिका प्राथमिक स्तर पर पर्यावरणीय अध्ययन-विज्ञान में शिक्षण सामग्री श्रृखला का एक अंग है। यह पुस्तिका रा.शै.अ.प्र.प. द्वारा भारत-जर्मन परियोजना शीर्षक ''मध्य प्रदेश और उत्तर प्रदेश में प्राथमिक और मिडिल विद्यालयों मे समुन्नत विज्ञान शिक्षा'' के अन्तर्गत विकसित की गई है। इस परियोजना के मुख्य घटक है विज्ञान किट का विकास और निर्माण, मुद्रित शिक्षण सामग्री का विकास और अध्यापकों का प्रशिक्षण। परियोजना का समन्वयन और अनुवीक्षण रा शै अ.प्र.प. नई दिल्ली के कर्मशाला विभाग द्वारा किया जा रहा है। आशा की जाती है कि इससे इन राज्यो में प्राथमिक स्तर पर विज्ञान शिक्षण मे गुणात्मक सुधार लाने के लिए ठोस आधार प्रस्तुत होगा। यह परियोजना हाल ही मे राष्ट्रीय शिक्षा नीति-1986 (एन पी.ई) और कारवाई के लिए बनाये गए कार्यक्रम (पी.ओ.ए) के अंतर्गत तैयार की गई योजनाओ को तकनीकी और तर्कसगत समर्थन प्रदान करने के लिए निश्चित की गयी है। इस प्रकार ''ऑपरेशन ब्लैक बोर्ड'' (ओ बी.) योजना के अतर्गत प्राथमिक स्तर पर आवश्यक सुविधा प्रदान करने के लिए शिक्षक पुस्तिका, प्राथमिक विज्ञान किट और किट नियमावली सूचीबद्ध पैकेज के महत्वपूर्ण अग के रूप मे है। यह पुस्तिका राज्य विज्ञान शिक्षा संस्थान-इलाहाबाद, विज्ञान किट कर्मशाला-भोपाल, कर्मशाला विभाग रा.शै.अ.प्र.प. नई दिल्ली, के शैक्षिक दल के सदस्यों, जर्मन विशेषज्ञों और प्राथमिक विद्यालयो के अध्यापको द्वारा किए गये सराहनीय टीम कार्य का परिणाम है। पहले वर्तमान पाठ्यचर्या संरचना, दिशानिर्देश, और ''पर्यावरणीय अध्ययन-विज्ञान'' के पाठ्य-विवरण का विभिन्न कोणो से विश्लेषण किया गया और इसके बाद विषय-वस्तु पर शिक्षण क्रियाकलापो का गठन, शैक्षणिक दल द्वारा किया गया। आशा की जाती है कि यह शिक्षक पुस्तिका वैज्ञानिक संकल्पनाओं के क्रमबद्ध विकास को आगे बढाने के लिए पाठ्यपुस्तक का संपूरक होगी।

मै जी टी.जैड़, श्री वी. वाईसर, सलाहकार और जर्मन दल नेता, श्री एच.एच. प्रोवे, तकनीकी विशेषज्ञ और अन्य अल्पकालीन विशेषज्ञों को उनकी सहायता और सुविज्ञता के लिए धन्यवाद ज्ञापित करता हूँ। निदेशक, राज्य शैक्षिक अनुसधान एव प्रशिक्षण परिषद् (उ.प्र.), लखनऊ, निदेशक, रा.वि.शि.स., इलाहाबाद, प्रधान सचिव, सी पी.आई., डी.पी.आई. (म प्र.) भोपाल भी, सहयोग प्रदान करने और गहन रूचि लेने के लिए धन्यवाद के पात्र हैं। मै प्रो. पी.के भट्टाचार्य, अध्यक्ष, कर्मशाला विभाग और उनके सहयोगियो का आभारी हूँ जिन्होने परियोजना की योजना के प्रचालन के विभिन्न घटको मे समन्वयन और कार्यान्वयन किया है। मै डा बी के. शर्मा जिन्होने परियोजना के शैक्षणिक कार्यकलापों का समन्वयन और अनुवीक्षण किया है, को, उनके समीक्षात्मक पुनरीक्षण और पांडुलिपि को अन्तिम रूप देने हेतु धन्यवाद देता हूँ। मै लेखन दल के सभी सदस्यों, विषय विशेषज्ञो, पुनरीक्षको और प्रतिभागी शिक्षको और जिन सस्थानों से वे सम्बन्धित है, का भी, उनके योगदान के लिए आभारी हूँ।

मै आशा करता हूँ कि प्राथमिक विद्यालय शिक्षक, इस पुस्तिका को अपने लिए उपयोगी और रूचिकर पाएगें। पुस्तिका मे और अधिक सुधार लाने के लिए दिए गये सुझावो और विचारों का स्वागत है। पुस्तिका के वर्तमान सस्करण का सशोधन करते समय परिषद् इस प्रकार के सुझावो और विचारों पर गम्भीरतापूर्वक विचार करेगी।

नई दिल्ली
17 नवम्बर, 1988

पी.एल. मल्होत्रा
निदेशक
राष्ट्रीय शैक्षिक अनुसधान और
प्रशिक्षण परिषद्

आमुख

प्राथमिक स्तर पर पर्यावरणीय अन्वेषण हेतु छात्र-केन्द्रित तथा क्रिया-आधारित उपागम की संस्तुति की गई है। इस प्रकार का उपागम आत्मविश्वास, विवेक पूर्ण दृष्टिकोण, जिज्ञासा, अन्वेषण भावना, सर्जनात्मकता, वस्तुनिष्ठता, प्रश्न पूछने का साहस, पहल शक्ति और सत्य तथा सौंदर्य परक मूल्यों की सराहना जैसी अभिवृत्तियो एव गुणो के विकास मे पर्याप्त अवसर प्रदान करेगा। इससे दैनिक जीवन यापन और पर्यावरणीय परिस्थितियो मे सुधार लाने के लिए जीवन में तर्कसंगत एवं स्वतत्र चिन्तन, प्रेक्षण, तर्कशक्ति, विश्लेषण, व्याख्या, समस्या समाधान एव निर्णय जैसे कौशलो के संवर्धन मे सहायता मिलेगी। इस संदर्भ में अध्यापक की भूमिका बहुत महत्वपूर्ण है। अध्यापकों को मात्र वैज्ञानिक ज्ञान देने और इसका प्रसार करने की अपेक्षा क्रिया को सरल बनाना चाहिए, अन्वेषण में सहायक होना चाहिए तथा सीखने सम्बन्धी ससाधनो को पहचानने में मार्गदर्शक का रूप अपनाना चाहिए। सीखने की परिस्थितियो का सर्वाधिक लाभ प्राप्त करने के लिए शिक्षण सामग्री के रूप मे शिक्षक पुस्तिका की नितान्त आवश्यकता है, जिससे अध्यापको को सीखने, सिखाने की प्रक्रिया को अधिक लचीला बनाने में सहायता मिलेगी।

यह पुस्तिका अध्यापकों की नई भूमिका तथा प्राथमिक विद्यालय के शिक्षको एवं शिक्षक-प्रशिक्षकों के सेवाकालीन और सेवा पूर्व प्रशिक्षण को ध्यान मे रखते हुए विकसित की गई है। यह पुस्तिका चार भागो मे विभाजित है। प्रथम भाग में इसके उपयोग विधि से सबन्धित सामान्य अनुदेश दिए गए है। इसके बाद के दो भागों में विज्ञान सीखने के उपागम एव उपलब्ध स्थानीय सामग्री का उपयोग बताया गया है। चौथे भाग मे छात्र-केन्द्रित क्रिया कलापो के विवरण पर प्राथमिक अध्यापको को इकाई के अनुसार व्यापक अनुदेश दिए गए हैं। छात्र इस पुस्तिका में दिए गये अधिकांश क्रियाकलापों को प्राथमिक विज्ञान किट मे उपलब्ध वस्तुओं की सहायता से आसानी से कर सकते हैं। छात्र के पर्यावरण सम्बन्धी प्रेक्षण पर आधारित क्रिया कलाप-स्थानीय उपलब्ध सामग्री के उपयोग से किए जा सकते है। तथापि, प्राथमिक विज्ञान किट की कुछ वस्तुओं की आवश्यकता पड़ सकती है। इस शिक्षक पुस्तिका का विकास अनेक स्तरो पर किया गया है। सर्वप्रथम राज्य विज्ञान शिक्षा संस्थान, इलाहाबाद, विज्ञान किट कर्मशाला, भोपाल और कर्मशाला विभाग, रा.शै.अ.प्र.प., नई दिल्ली, मे स्थापित शैक्षिक दल के सदस्यों द्वारा, रा.शै.अ प्र प तथा इन राज्यों में तैयार पाठ्य चर्या सरचना, दिशा निर्देश, पाठ्य विवरण तथा अन्य सामग्री का विश्लेषण किया गया। तत्पश्चात अधिगम परिणाम, प्रस्तावित शिक्षण प्रक्रम और साधन एवं सामग्री सहित प्रारूप का विकास किया गया। तकनीकी दल ने प्रथमत. प्राथमिक विज्ञान किट के समानांतर प्रथम "प्रोटोटाइप" विकसित किया। दोनों टीमो के मध्य निरन्तर पारस्परिक संपर्क बनाए रखा गया। इस शिक्षक पुस्तिका और प्राथमिक विज्ञान किट को, पहले कृत्रिम परिस्थितियों में तथा बाद में उ.प्र., म प्र. और दिल्ली के चुने हुए प्राथमिक विद्यालयों में परीक्षण के बाद ही अंतिम रूप दिया गया। पांडुलिपि के प्रारूप को परियोजना से सम्बन्धित समस्त शिक्षाविदो एवं इस क्षेत्र मे कार्यरत कुछ संगठनों और संस्थाओं को भेजा गया। इस प्रकार परीक्षण से प्राप्त परिणामों एवं पुनर्निवेशन पर विचार विमर्श किया गया, उनका विश्लेषण किया गया और उन्हें शिक्षक पुस्तिका के अन्तिम रूपान्तर में समाविष्ट किया गया। इस शिक्षक पुस्तिका और प्राथमिक विज्ञान किट के विकास तथा परीक्षण में शहरी और ग्रामीण दोनों क्षेत्रों के प्रतिनिधि अध्यापकों ने भाग लिया। इनमें विज्ञान और विज्ञानेतर-दोनो पृष्ठ भूमि वाले, अध्यापक सम्मिलित हुए।

हम श्री एच हर्टमैन, श्री वर्ग मैन और डा. एच. बेयर के प्रति आभार व्यक्त करते हैं जिन्होंने इस परियोजना संगोष्ठी नियोजन में महत्वपूर्ण योगदान दिया। हम डा लॉटर बैक और डा. स्कोएनहर का धन्यवाद करते हैं जिन्होंने शिक्षण और अध्यापक प्रशिक्षण सामग्री तैयार करने मे सहायता दी। हम म.प्र. और उ प्र. के 252 प्राथमिक विद्यालयों में सर्वेक्षण हेतु श्रीमति आइ.वास एव शिक्षक-पुस्तिका के प्रथम प्रारूप सहित परियोजना के परिणामो के मूल्याकन हेतु श्री स्मिट, डा. रौठ तथा प्रो. आर.एन. मेहरोत्रा के आभारी है। विज्ञान शिक्षा संस्थान, कील (सघीय जर्मन गण राज्य) के डा. आर. लॉटरबक के व्याख्यान एव परामर्श, इस पुस्तिका के लेखन दल के सदस्यों हेतु बहुत लाभदायक पाए गए।

हम प्रो. पी.एल मल्होत्रा, निदेशक, प्रो. ए.के जलालुद्दीन, संयुक्त निदेशक, रा शै.अ.प्र.प , का सक्रिय रूप से मार्गदर्शन प्रदान करने के लिए धन्यवाद व्यक्त करते हैं। प्रो.पी.एन दवे, अध्यक्ष, डी पी. एस.ई.ई., प्रोफेसर वी गांगुली, अध्यक्ष, डी.ई एस एम और प्रो. ए के. शर्मा, अध्यक्ष, डी.टी.ई. एस.ई. एव ई.एस और उनके सहयोगियो द्वारा दिए गए सुझावो के लिए धन्यवाद देते है। हम कर्मशाला विभाग के सहयोगियों, लेखक दल, सपादकों, सलाहकारो, प्रतिभागी अध्यापको तथा उनकी संस्थाओं के आभारी है जिनके परिश्रम से यह प्रकाशन सभव हुआ। हमें आशा है कि प्राथमिक विज्ञान शिक्षा से सम्बद्ध शिक्षकों और शिक्षक-प्रशिक्षको के लिए यह पुस्तिका उपयोगी सिद्ध होगी। इस पुस्तिका मे और अधिक सुधार हेतु सम्बन्धित सुझावों का स्वागत है।

वी. वाईसर
शैक्षिक परामर्शदाता एवं
जर्मन दल नेता
नई दिल्ली
11 नवम्बर, 1988

पी.के. भट्टाचार्य
अध्यक्ष, कर्मशाला विभाग तथा
परियोजना समन्वयक

विषय सूची

1. इस पुस्तिका का उपयोग कैसे करें?

इस पुस्तिका का उद्देश्य कक्षा 5 की विज्ञान की पाठ्यपुस्तक (पर्यावरणीय अध्ययन) की विभिन्न इकाइयों के लिए शिक्षार्थी-केन्द्रित विभिन्न क्रियाकलाप प्रदान करना है। इन क्रियाकलापो का अभिप्राय छात्रो को स्वयं के प्रेक्षपों द्वारा पर्यावरण की छान बीन करने के लिए प्रोत्साहित करना है। पुस्तिका मे ऐसे क्रियाकलापो का उल्लेख है जिनमे से अधिकाश को प्राथमिक विज्ञान किट मे उपलब्ध वस्तुओं से सम्पन्न किया जा सकता है। कुछ क्रियाकलापों को सम्पन्न करने में किट की आवश्यकता शायद न भी हो क्योंकि वे शिक्षार्थी के अनुभवों पर आधारित हैं। प्रत्येक इकाई में प्रश्न के रूप में समस्यामूलक प्रकरणो का समावेश है जिनके लिए 1.1, 1.2 आदि संख्याओं का प्रयोग किया किया गया है। प्रत्येक प्रकरण से सम्बन्धित क्रियाकलापों के लिए 1.2.1, 1.2.2, 1.2.3, आदि संख्याओं का प्रयोग किया गया है। उदाहरणार्थ 1.2.3 का अर्थ है इकाई 1, उपइकाई 2, क्रियाकलाप 3 तथा 1.6. विस्तारण 2 का अर्थ है इकाई 1, उपइकाई 6 तथा विस्तारण 2 कुछ प्रकरणों से संबंधित क्रियाकलापों को सम्पन्न करने के लिए यह नितात आवश्यक होगा कि इसकी तैयारी पहले से कर लें। विभिन्न प्रकरणों से सम्बन्धित क्रियाकलापो के लगातार कई कालांश तक चलने तथा किसी प्रकरण/क्रियाकलाप के परिणामों को अन्य क्रियाकलापों के उपयोग में लाने के लिए, सुझाव भी दिए गए है। विभिन्न क्रियाकलाप सम्पन्न करके प्रकरण पूरा करने के लिए अनुमानित समयावधि भी प्रस्तावित है। यदि आपकी रुचि अतिरिक्त क्रियाकलाप सम्पन्न करने में है तो इसके लिए आप स्वतत्र हैं।

क्रियाकलापों को सम्पन्न करने में आप द्वारा मार्गदर्शन किया जाय तथा सम्बोधों के क्रमागत विकास को सरल बनाया जाए.,इस दृष्टि से उद्देश्यों एवं संरचनात्मक सोपानो का भी सुझाव दिया गया है। क्रियाकलापों की अवधि में प्रोत्साहित करने के लिए प्रश्न तथा उनमे से कठिन प्रश्नों के उत्तर (आवश्यकतानुसार) सकेत सहित दिए गए है। किसी क्रियाकलाप को सम्पन्न करने के लिए आवश्यक साधन तथा सामग्री का भी उल्लेख है। साधन और सामग्री के स्तम्भ में किट की वस्तुओं को लाल अक्षरों में अंकित किया गया है। यदि आपकी समझ से किसी विशेष क्रियाकलाप को स्थानीय साधनों से उपलब्ध सामग्री से किया जा सकता है तो आप इन वस्तुओं का उपयोग करके उसे कर सकते हैं। स्थानीय साधनों से उपलब्ध सामग्री की सूची एक अलग अनुच्छेद 3 मे दी गई है। छात्रो द्वारा प्रेक्षणों के उचित अभिलेखन और उनसे निष्कर्ष निकालने के लिए आवश्यक तालिका आपकी सहायतार्थ उदाहरण सहित दी गई है। आप सारणियों को छात्रों द्वारा पूरी कराएं। अधिकाश क्रियालापो के बाद परियोजना कार्य, क्षेत्र-भ्रमण, सामूहिक विचार विमर्श, संकलन, चित्रांकन आदि के रूप में विस्तारण क्रियाकलाप दिए गए है। विस्तारण, क्रियाकलापों में आप स्थानीय परिस्थितियो एव साधनो से उपलब्ध सामग्री के अनुसार संशोधन कर सकते हैं अथवा उनमें कुछ जोड सकते हैं।

2. विज्ञान अधिगम उपागम

विगत वर्षो मे वैज्ञानिक ज्ञान में द्रुत गति से वृद्धि हुई है। मानव विचार, सामाजिक मूल्य, रीति एव सस्कृति मे परिलक्षित विज्ञान शिक्षा की आवश्यकता के परिप्रेक्ष्य मे जीवन की गुणवत्ता मे सुधार लाने के लिए विज्ञान पाठ्यक्रम तथा विज्ञान अधिगम उपागम का आधुनिकीरण अपरिहार्य हो गया है। राष्ट्रीय शिक्षा नीति (1986) के अनुसार किसी शिक्षार्थी को वैज्ञानिक दृष्टि से साक्षर नागरिक बनाने के लिए

— विज्ञान के मूल सम्बोधो को समझना तथा इनका अनुप्रयोग करना,
— वैज्ञानिक विधि से जांच और सूचना एकत्र करने के लिए आवश्यक कौशल प्राप्त करना,
— वांछित अभिवृत्ति, सत्यता का मूल्य एवं वस्तुनिष्ठता का विकास करना,
— सर्जनात्मक क्षमता का पोषण करना
— दैनिक जीवन, पर्यावरणीय परिस्थितियों तथा तकनीकी विकास और अनुप्रयोग के उन्नयन के लिए वैज्ञानिक पद्धति में निपुणता प्राप्त करना और इसका समस्या समाधान में उपयोग करने के लिए निर्णय लेने की क्षमता का विकास करना नितात आवश्यक है।

उपर्युक्त उद्देश्यों की पूर्ति हेतु यह आवश्यक है कि स्मृति और विषय वस्तु से सम्बद्ध शिक्षक-केन्द्रित शिक्षण विधि पर बल देने के स्थान पर

— समस्या समाधान आधारित,
— क्रियाकलाप आधारित
— और शिक्षार्थी-केन्द्रित उपागमो पर बल दिया जाय।

इसके लिए शिक्षार्थियों को

— छानबीन करने,
— प्रेक्षणो के अभिलेखन करने,
— सूचनाओ के सम्प्रेषण, इनकी संरचना एव व्याख्या करने
— परिकल्पना बनाने,
— आंकडों को सकलित एवं विश्लेषित करने
— प्रासंगिक निष्कर्ष निकालने,
— समस्या के हल की रूपरेखा तैयार करने एवं इसके अनुसार कार्य करने मे सम्मिलित करना अपेक्षित है।

चिन्तन और तर्क-वितर्क करने तथा समस्या समाधान हेतु विज्ञान को, एक उच्चकोटि के विवेक पूर्ण, बौद्धिक मानवीय क्रियाकलाप के रूप मे समझने का यह पर्याप्त अवसर प्रदान करता है। यह जीवन की वास्तविक परिस्थितियो एव समस्याओं के परिप्रेक्ष्य में, आत्मविश्वास, जिज्ञासा, नेतृत्व, स्वावलम्बन, अध्यवसाय तथा अभिनव कौशल विकसित करने मे सहायक हैं। इन वैज्ञानिक प्रक्रियाओ तथा कौशलो द्वारा सम्बोधों का क्रमिक विकास किया जा सकता है। तथापि अधिगम परिस्थितियों का सर्वोत्तम उपयोग करने के लिए यह नितांत आवश्यक है कि शिक्षक को पाठ्य पुस्तकों के अतिरिक्त शिक्षण सामग्री भी प्रदान की जाय। किसी छान बीन के लिए आपको पहले से ही उसकी योजना तथा सामान्य रूपरेखा

बना कर पर्याप्त तैयारी कर लेनी चाहिए। पाठ्य पुस्तक तथा इस पुस्तिका से सम्बन्धित विषय वस्तु का आप अध्ययन कर उसमे निहित वैज्ञानिक, विचारों, उनके दैनिक जीवन में अनुप्रयोग और छानबीन द्वारा विकसित की जाने वाली अधिगम प्रक्रियाओ का विवरण तैयार कर ले। इस पुस्तिका में आपको शिक्षार्थी केन्द्रित अधिगम अनुभवों तथा क्रियाकलापों के विवरण के रूप में आवश्यक शिक्षण सामग्री प्रदान करने का प्रयास किया गया है। इस मे किट की वस्तुओ के उपयोग तथा शिक्षार्थी के स्वय के अनुभवों के आधार पर अनुसंधान हेतु सकेत और आवश्यक प्रायोगिक कौशलों का भी समावेश किया गया है। पुस्तिका में प्रस्तावित क्रियाकलापों का कक्षा में जाने से पूर्व पूर्णपरीक्षण आवश्यक है। उपलब्ध स्थानीय ससाधनों द्वारा भी आप छानबीन कर सकते हैं।

प्रस्तुत विज्ञान अधिगम उपागम द्वारा आप को ऐसा अवसर उपलब्ध होता है, जिसके अन्तर्गत शिक्षक के रूप मे आपको मात्र वैज्ञानिक ज्ञान के सम्प्रेषक के रूप मे ही नहीं अपितु क्रियाकलापों के सम्पन्न करने में एक सहायक और सह-अनुसंधाता के रूप मे भी कार्य करना है। इस प्रकार आप सह शिक्षार्थी भी रहेंगे।

पर्यावरण को एक संसाधन के रूप में प्रयोग करते हुए शिक्षार्थी के स्वय के अनुभव, अन्वेष्णात्मक समस्या समाधान उपागम तथा स्वयं करके सीखने और क्रिया पक्ष पर आप द्वारा विशेष बल दिया जाना अपेक्षित है। प्राथमिक विज्ञान किट अथवा स्थानीय संसाधनो से उपलब्ध सामग्री के उपयोग द्वारा उचित अधिगम परिस्थितियां उत्पन्न करने के लिए शिक्षार्थियों को, प्रोत्साहन दे।

शिक्षार्थी केन्द्रित उपागम के अन्तर्गत सभी क्रिया कलापो को स्वयं अथवा छोटे-छोटे समूहो में सम्पादित करे तो श्रेयस्कर होगा। सम्भव है कि आपको प्राथमिक विज्ञान किट मे उपलब्ध वस्तुओ की सीमित संख्या के कारण कुछ प्रकरणो पर सम्पूर्ण कक्षा के समक्ष प्रयोग प्रदर्शित करना पडे। उचित अधिगम परिस्थितियो व्यक्तिगत या छोटे समूह में छात्रो द्वारा छानबीन विचार-विमर्श या परियोजना कार्य सम्पन्न करने मे तथा रटने की प्रवृति कम करने और स्वतत्र चिन्तन को प्रोत्साहित करने में सहायक होती है।

किसी क्रियाकलाप की अवधि के विभिन्न चरणो एव अनुक्रमो की सुविचारित एवं कौशलपूर्ण प्रेक्षण एक रोचक अनुभव तथा खोज विधि का प्रमुख अंग है। दैनिक जीवन मे रहन-सहन ओर पर्यावरण की दशा सुधारने तथा तकनीकी के अनुप्रयोग के प्रोत्साहन हेतु छात्रो को आत्म-विश्वासी वनाने, स्वतत्र रूप से समस्या का समाधान करने मे सक्षम बनाने के लिए, छानबीन की अवधि में आपको उपयुक्त प्रश्न पूछना चाहिए।

यदि किसी क्रियाकलाप को पूरा करने मे सफलता न मिले तो आप हतोत्साहित न हों। ऐसी परिस्थिति में छात्रो के साथ असफलता के कारणो का विश्लेषण कीजिए और अधिकतम तर्कसगत सुझाव के अनुसार पुनः परीक्षण करें। यदि फिर भी सफलता न मिले तो वैकल्पिक योजना बना कर क्रियाकलाप के सफल होने तक परीक्षण करते रहिये। किसी क्रियाकलाप की अवधि में इससे सम्बन्धित प्रक्रम को नियंत्रित करने वाले विभिन्न चरणों की खोज विधि के रूप मे बार-बार दोहराने से शिक्षार्थी नई खोज मे लगे एक उभरते हुए वैज्ञानिक, नया अनुसधान करते हुए अभियता अथवा नवीन चित्रांकन का सृजन करते हुए एक चित्रकार की तरह, सम्पूर्ण प्रक्रिया को भलीभांति समझने मे समर्थ हो जाता है।

कक्षा के बाहर सम्पन्न किए जाने वाले क्रियाकलापों के रूप में आप क्षेत्रीय भ्रमण तथा बाह्य परियोजनाओं का आयोजन कीजिए। ताकि छात्र बाहर जा कर पर्यावरण को समझने के अवसर प्राप्त करे, क्योंकि दर्शन, श्रवण, घ्राण एवं स्पर्श अनुभव के आधार पर ज्ञान प्राप्त करना अधिगम का एक बहुत रोचक तथा शिक्षाप्रद ढग है। छात्रों को व्यक्तिगत रूप मे अथवा छोटे समूह मे पर्यावरणीय वनस्पति तथा जीव जन्तु के प्रेक्षण हेतु निर्दिष्ट कीजिए। उनके अनुभवो को कक्षा मे प्रस्तुत करने एव इनका आदान प्रदान करने के लिए उनका आह्वान कीजिए। छात्रों के जीवन्त विचार विमर्श मे आपका सक्रिय प्रतिभाग अपेक्षित है।

श्रव्य-दृश्य साधन अधिगम मे सहायक होते हैं। श्यामपट्ट पर बनाए गए बड़े चित्रों की सहायता से छात्रों को प्रभावी ढंग से समझाया जा सकता है, इसलिए श्यामपट्ट भी एक महत्वपूर्ण साधन हैं। अधिगम हेतु अपने विचारों को स्पष्ट करने मे श्यामपट्ट के अधिकाधिक प्रयोग के लिए छात्रों को प्रोत्साहित कीजिए।

आप से अपेक्षा की जाती है कि आप विज्ञान किट मे उपलब्ध चार्टो का उपयोग प्रभावी ढग से करें। आपको, अधिगम हेतु उचित एव अर्थपूर्ण क्रियाकलापों जैसे चार्ट बनाना, साधारण एव निर्मूल्य प्रतिमान बनाना, पत्रिकाओ और समाचार पत्रो से सकलन करना आदि को सम्पन्न करने के लिए छात्रो को प्रोत्साहित करना चाहिए। यह अतिरिक्त अधिगम हेतु उचित लक्ष्य प्राप्त करने मे सहायक होगा।

3. स्थानीय साधनों से उपलब्ध वस्तुओं का उपयोग

बहुत सी वस्तुएं या तो रद्दी मे पाई जाती है या निमूल्य अथवा कम मूल्य पर स्थानीय साधनो से उपलब्ध हैं। इनका उपयोग कक्षा के क्रियाकलापों को प्रदर्शित करने के लिए उपकरणो के निर्माण के लिए किया जा सकता है। ऐसी वस्तुओ की सूची कुछ प्रयोगों/उपकरणो के विवरण के साथ नीचे दी जा रही है। तथापि इस सूची मे, आप किसी अन्य उपयुक्त वस्तु को सम्मिलित कर सकते हैं।

क. स्थानीय साधनों से उपलब्ध वस्तुओं की सूची

1. बाल्टी/कनस्तर
2. प्लास्टिक के पात्र/काँच की बोतल
   (मिट्टी के तेल मे भीगे हुये धागे को बोतल के चारो और उचित स्थान पर लपेट कर और फिर धागे को जला कर बोतल को काट कर इनका उपयोग गिलास के रूप मे किया जा सकता है)
3. फ्यूज विद्युत बल्ब, आवर्धक लैन्स की तरह और गर्म करने के लिए पात्र के रूप मे
4. माचिस के डिब्बे विभिन्न पदार्थों अथवा बाटो को रखने के पात्र के रूप में
5. चम्मच
6. रबर बैन्ड
7. रबर के गुब्बारे
8. धागा/फीता

9. कागज/प्लास्टिक की थैलियां
10. डिब्बे
11. छोटा दर्पण/काच की शीट/ऐलुमिनियम की पन्नी/सेलोफेन का कागज/चार्ट का कागज
12. गमला, पात्र के रूप मे
13. बेकार पिचकारी द्रव मापन के लिए और ड्रापर की तरह
14. सरकण्डे, विभिन्न प्रकार की आकृतिया और प्रतिमान बनाने के लिए
15. विभिन्न प्रकार के कपड़ो के कतरन, शिल्प कार्य और गुडिया बनाने के लिए
16. मोमबत्ती
17. मिट्टी का गेंद, बॉट/शिल्प सामग्री के रूप मे
18. रबर गेद
19. मिट्टी के पात्र
20. दवा डालने वाला ड्रापर
21. कांटे, काटने/वस्तुओ को जड़ने के लिए
22. कील, पेच, तार/तार की जाली
23. धावन सोडा
24. शक्कर
25. साधारण नमक
26. मिट्टी के तेल का बर्नर
27. स्याही और रंग/पेन्ट
28. बीज
29. पत्तियां
30. शंख/नारियल का कवच
31. पक्षियों के घोंसले
32. स्थानीय चट्टान, खनिज पदार्थ
33. टूटे हुए चुम्बक
34 पाउडर के खाली डिब्बे
35. जाटर रिफिल, फूंकने वाली नली के रूप मे
36. बोतलो के ढक्कन, छोटे पात्र के रूप मे
37. अगरबत्ती

ख. वस्तुओं का निर्माण

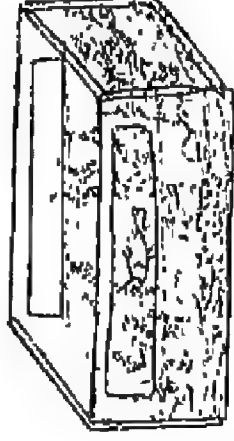
ख. I टेरेरियम (स्थल जीव शाला) की व्यवस्था करना

उद्देश्य मिट्टी मे रहने वाले छोटे पौधों एवं जन्तुओ के लिये स्थापित स्थल जीवशाला एक पर्यावरण है। स्थलीय एवं जल स्थलचल जन्तुओं के अध्ययन के लिये यह उपकरण स्थापित किया जा सकता है।

आवश्यक सामग्रीः खाली तेल का एक कनस्तर/बडा वर्तन, रेत, मिट्टी, प्लास्टिक शीट/पॉलीथीन की पन्नी, पत्थर के टुकड़े, पौधे, पत्तियो का साचा, टिन कटर।

व्यवस्थित करने की विधिः एक साफ किये हुये कनस्तर मे दो विपरीत दिशा में उचित आकार के कुछ बडे छेद बनाये जो खिडकी का काम करें। टिन कटर की सहायता से कनस्तर का ऊपरी भाग भी हटा सकते है। इसका दूसरा सिरा तली का कार्य करने के लिये बिना कटा छोड दिया जाता है। हटाये जा सकने वाले पारदर्शी प्लास्टिक शीट या पॉलीथीन की पन्नियों से इन छिद्रो को ढक देते है। हवा के आने जाने के लिये छोटे छिद्र छोड दिये जाते हैं।

पानी बहने के लिये एक जार मे दुर टुरे पत्थर से लगभग 2-3 से.मी गहराई तक भरे। मुट्ठी भर चारकोल भी इसमे सहायक है। इसमे दो भाग बाग की मिट्टी, दो भाग मोटा रेत और एक भाग पत्ती का सोचा मिलाइये। सघन मिट्टी प्रयोग न करें। मिट्टी को एक ऊंचे ढलवा सिरे पर डालिये। जब तक पौधे ठीक से जम न जाये. मिट्टी को अधिक न दवाये, ढीली ही रहने दे। पौधो को ऊपर से तराशिये तथा जडो को ठीक आकार दीजिये। एक लकडी से मिट्टी में छेद बनायें और इन छिद्रो मे पौधों को जमायें। जब पौधे अच्छी प्रकार लग जाये तो इन पर धीरे से पानी छिडके। तुम्हारी स्थल जीवशाला तैयार है। कुछ निश्चित दिनों बाद इसकी जांच करें तथा परिवर्तन को अंकित करें।

मेढ़कों के अध्ययन के लिये इसको दो भागो-सूखे एव गीले, में बांटा जा सकता है। यदि प्राप्त हो तो तार की जाली से छिद्रों को बन्द कर दे जिससे कि जन्तु इन छिद्रो से भाग न सकें।

4. क्रियाकलापों का विवरण

इस अनुच्छेद मे आपको सात इकाईयो-सजीव वस्तुए; मानव शरीर पोषण तथा स्वास्थ्य; मृदा अपरदन और इसका सरक्षण; वायु और इसकी उपयोगिता; बल, कार्य तथा ऊर्जा; पृथ्वी और आकाश; पृथ्वी की प्राकृतिक संपदा के विषय में शिक्षार्थी केन्द्रित अधिगम अनुभवो से सम्बन्धित आवश्यक जानकारी उपलब्ध कराने का प्रयास किया गया है। आशा है कि सुझाए गए ये क्रियाकलाप शिक्षार्थियो को उनके दैनिक जीवन के अनुभवो एवं प्रेक्षणो द्वारा पर्यावरण की छानबीन के लिए पर्यावरण एव किट के सामानो से विभिन्न क्रियाकलापों को सम्पन्न करने के लिए आवश्यक अन्वेषण केन्द्र बिन्दु एवं प्रायोगिक कौशल प्रदान करने के लिए प्रोत्साहित करेंगे। क्रियाकलापो को कक्षा की वास्तविक परिस्थितियों मे करने के पूर्व आपको इनका इस अनुच्छेद मे दिए गए सुझावों के अनुसार परीक्षण कर लेना चाहिए।

इकाई 1: सजीव वस्तुएं

(वृद्धि पर सजीवों में उद्दीपन के प्रति अनुक्रिया; सजीवों में श्वसन तथा प्रजनन; सजीवों में अनुकूलन; बीजों से नवोद्भिद पौधे)

प्रस्तावना

कक्षा तीसरी एव चौथी मे छात्र सजीव तथा निर्जीव वस्तुओ के सामान्य लक्षणों के बारे मे पढा चुके हैं। उन्होंने यह भी पढ़ लिया है कि पेड पौधे ही ऐसी सजीव वस्तुएं हैं जो स्वय अपना भोजन कार्बन डाइ-आक्साइड तथा पानी से तैयार करते है क्योंकि ये हरे वर्णक—पर्णहरित से युक्त होते हैं।

इस इकाई के द्वारा छात्र:

— जन्तुओ और पौधो मे अतर बताने मे,
— सजीव और निर्जीव वस्तुओ में अंतर बताने में,
— पौधे और जन्तु अपने आपको अपने वातावरण के अनुसार अनुकूलित कैसे कर लेते है के समझने मे,
— यह आवश्यक नही है कि एक पौधे के सभी बीज समान आकार मे वृद्धि करते हैं, के समझने मे,
— अकुरण और वृद्धि की परिस्थितियो को समझने मे, समर्थ होंगे।

1.1: क्या सजीव वस्तुये, निर्जीव वस्तुओं से विभिन्न होती हैं?
केंद्रित करें: सजीव तथा निर्जीव वस्तुओं में अन्तर

(कालाश 4-5)

अधिगम परिणाम	प्रस्तावित शिक्षण प्रक्रम	साधन एव सामग्री
	क्रियाकलाप 1	
सजीव तथा निर्जीव वस्तुओ के लक्षणोंमे अन्तर पहचानना	चार्ट की सहायता से छात्रों से परिचर्चा करे। उनसे पूछिए: तुम क्या देखते हो? यह किस प्रकार एक-दूसरे से भिन्न हैं। छात्रो से कहिए कि वे एक छोटा-सा पौधा लगा गमला लें। उस पौधे की बगल से एक सूखी लकड़ी की छड़ी लगा दो। पौधे तथा छड़ी की लम्बाई नाप कर लिख लो। तीन सप्ताह बाद पौधे तथा छड़ी को देखो तथा उसकी लम्बाई नापो।	शिशुओं को अपने प्रांतों के साथ दर्शाने का चार्ट
	उनसे पूछिए: पौधे की लम्बाई मे तुमने क्या अन्तर देखा?	एक छोटा-से गमले में लगा पौधा, एक सूखी लम्बी लकडी की छडी, मापने वाला फीता

पौधा तथा वृक्ष

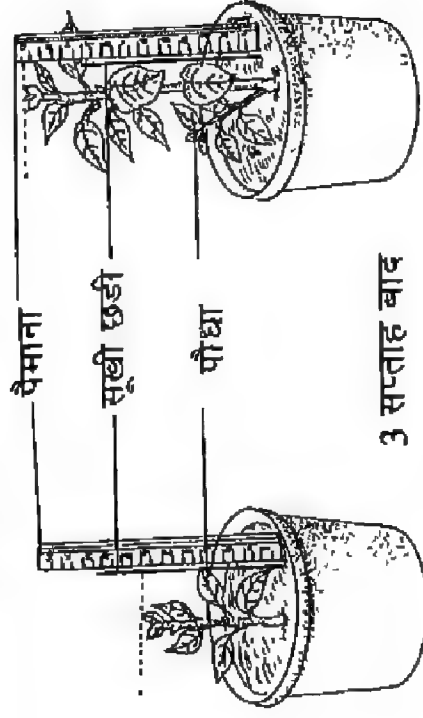
कुतिया और पिल्ले

बिल्ली और बिल्ली के बच्चे

मुर्गी और चूजे

शिशु अपने व्यस्कों के साथ

(पौधे की लम्बाई बढ गई)
छडी की लम्बाई में तुम्हें क्या अन्तर मिला?
(छडी की लम्बाई में कोई अन्तर नहीं आया, अतः इसमें वृद्धि नहीं हुई)
यह निष्कर्ष निकालने मे छात्रों की सहायता कीजिए कि सजीव वस्तुएं जैसे पौधे तथा जन्तु वृद्धि करते है जब कि निर्जीव (जैसे छड़ी) वृद्धि नहीं करती है।

पौधे की वृद्धि

क्रियाकलाप 2

ज्ञान कराना कि सजीव वस्तुयें श्वसन करती हैं

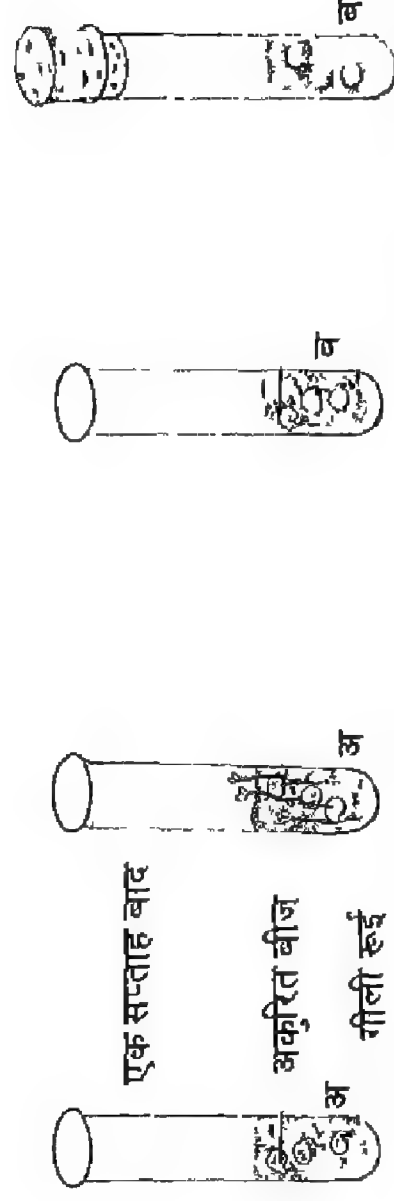
छात्रों से कहिये कि वे अपने वक्ष की गति का निरीक्षण करें।
उनसे कहिये कि वे अपने हाथ से कुछ क्षणों के लिये मुख बन्द करके अपनी नाक को, दाबे।

उनसे पूछिए:
तुम कैसा अनुभव करते हो?
(बेचैनी)

क्या अधिक समय तक तुम अपनी नाक बन्द रख सकते हो?
(नहीं, कुछ क्षणो के लिए ही)
क्यो?
(श्वास नहीं ले सकते)
श्वांस लेते समय कौन-सी गैस अन्दर लेते हैं?
(आक्सीजन)
श्वांस छोड़ते समय कौन-सी गैस बाहर निकालते हैं?
(कार्बन डाइआक्साइड)

क्रियाकलाप 3

छात्रों से कहिये कि वे दो अलग-अलग परखनलियो जिसमें गीली की गई रूई रखी गयी हो, में अंकुरित बीज ले और उन्हें 'अ' तथा 'ब' से नामांकित करें

दो परखनली काक रूई, अंकु बीज, पानी

अंकुरित बीज स्वस्थ दिखाई देते है

अंकुरित बीज नष्ट दिखाई देते है

परखनली 'ब' को कार्क/ढ्क्कन-द्वारा अच्छी प्रकार से कसकर बन्द कर दीजिए।
एक सप्ताह बाद निरीक्षण कराइए।
उनसे निम्नलिखित प्रश्न पूछिए:
परखनली 'अ' में अंकुरित बीज किस अवस्था में हैं?
(स्वस्थ तथा ताजे दिखाई देते हैं)
परखनली 'ब' में अंकुरित बीज किस अवस्था में हैं?
(खराब/नष्ट हो गये हैं)
परखनली 'अ' के अंकुरित बीज स्वस्थ तथा ताजे क्यों हैं?
(श्वसन के लिये वायु मिलती है)
परखनली 'ब' के अंकुरित बीज नष्ट क्यों हो गए?
(उन्हे श्वसन के लिये वायु प्राप्त नहीं हुई)
(अंकुरित बीजों से कार्बनडाई-आक्साइड गैस निकलती है जो पानी में घुलकर कार्बोनिक अम्ल बनाती है जिससे अकुरित बीज नष्ट हो जाते है)

क्रियाकलाप 4

छात्रो से कहिए कि वे अकुरित बीजों के स्थान पर संगमरमर के टुकड़े लेकर इस क्रियाकलाप 1.1.3 को पुनः करें।

सगमरमर के टुकड़े

उनसे पूछिए:
संगमरमर के टुकड़ो में तुम क्या अन्तर पाते हो?
(उनकी दशा में कोई परिवर्तन नहीं मिला)
यह निष्कर्ष निकालने में उनकी सहायता कीजिए कि सजीव वस्तुएं जैसे पौधें एवं जन्तु, श्वसन करती हैं और निर्जीव वस्तुएं श्वसन नही करती हैं।

क्रियाकलाप 5

जानना कि सजीव वस्तुए उद्दीपन के प्रति अनुक्रिया दिखाती है।

छात्रों से कहिए कि वे अपनी बाहों मे धीरे से चुटकी काटें।

उनसे पूछिए:
तुम क्या अनुभव करते हो

जब तुम्हारा पैर किसी नुकीली वस्तु अथवा हाथ गर्म वस्तु पर पड़ जाता है तो तुम अपना पैर अथवा हाथ क्रमश: क्यो हटा लेते हो?
छात्रो से कहिए कि वे छुई-मुई (लाजवन्ती) के पौधे को छूकर देखे, यदि उपलब्ध हो।
उनसे पूछिए:

तुमने क्या देखा?

क्रियाकलाप 6

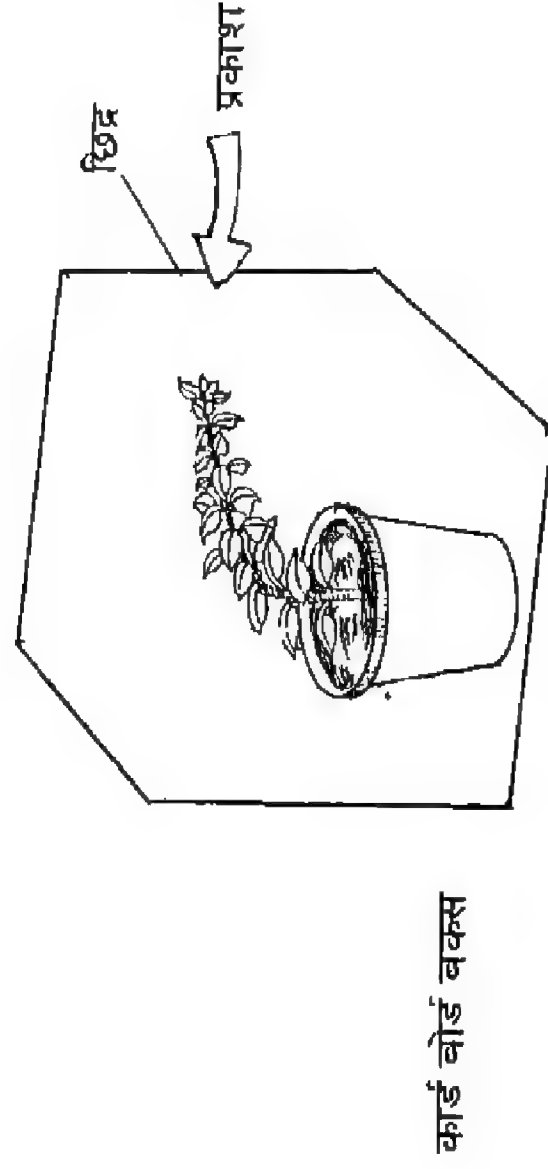
एक छोटे से गमले मे लगा पौधा, ढक्कन लगे कार्ड-वोर्ड के बक्स में रखिये और इसके एक ओर छिद्र कीजिए:

कार्ड-वोर्ड बक्स, गमले मे लगा पौधा

छात्रों से कहिए कि 7-10 दिनो वाद निरीक्षण करें।

उनसे पूछिए:
पौधों की वृद्धि किस दिशा मे हुई है?
पौधा प्रकाश स्रोत की ओर क्यो मुड़ गया?
यह निष्कर्ष निकालने मे उनकी सहायता कीजिए कि सभी सजीव वस्तुए (पौधे एवं जन्तु) वाह्य उद्दीपनों जैसे प्रकाश, आदि के प्रति अनुक्रिया दिखाती हैं।

प्रकाश की ओर पौधे की गति

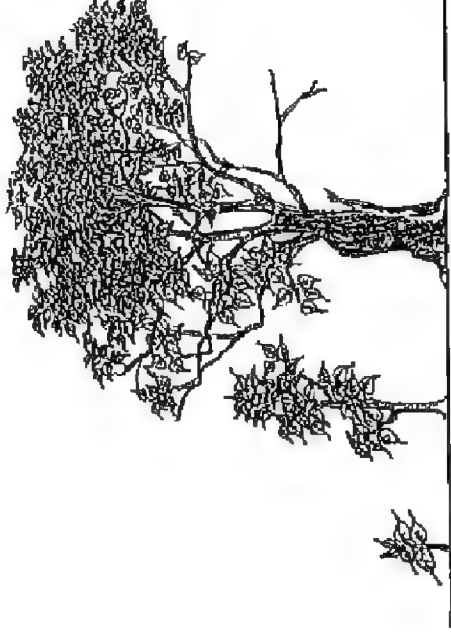
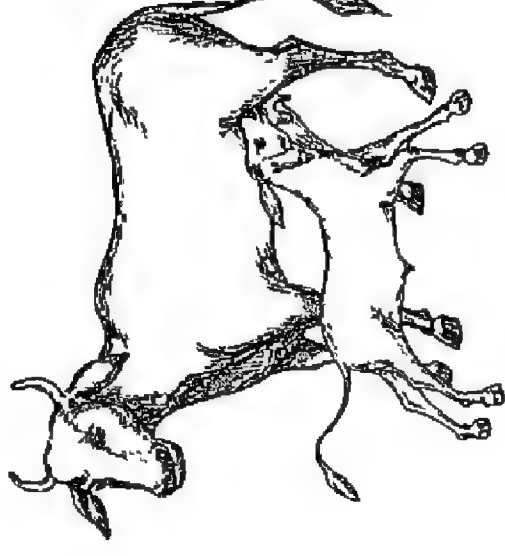
क्रियाकलाप 7

इस तथ्य को स्पष्ट करना कि सजीव वस्तुए अपने ही समान संतति उत्पन्न करती है

वह चार्ट दिखाईए जिससे पौधे तथा जन्तु शिशु अवस्था से प्रौढ़ बनते हुए दिखाई देते हैं।

शिशुओं का उनके व्यस्कों के साथ चार्ट

उनसे पूछिए:
तुम क्या देखते हो?

पौधा तथा वृक्ष

मुर्गी और चूजे

बिल्ली और बिल्ली के बच्चे

गाय और बछड़ा

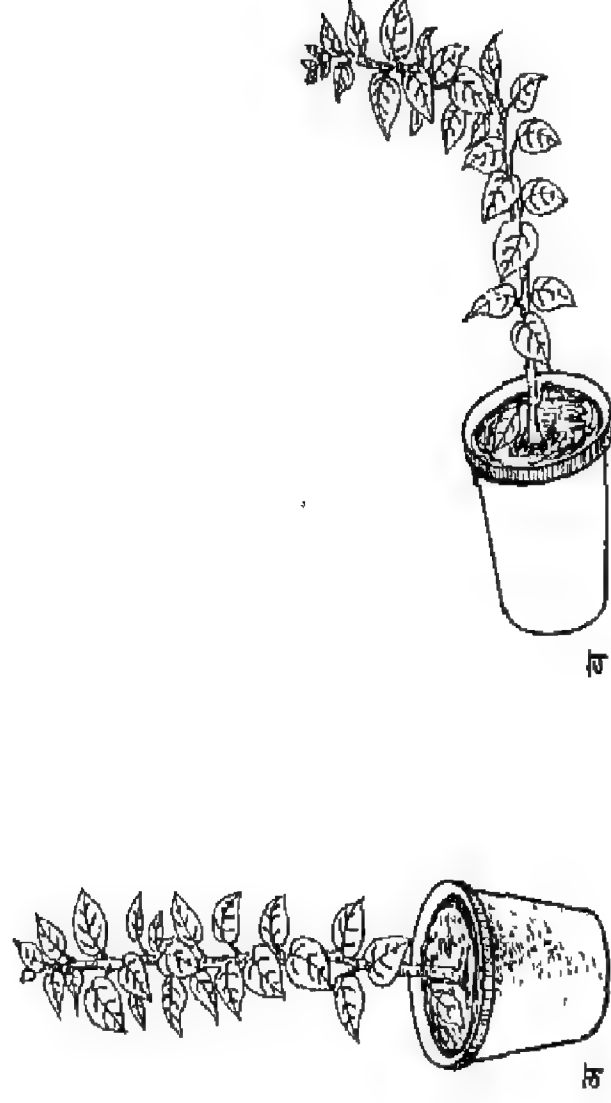
क्या तुम अपनी पेंसिल या रबर से दूसरी रबर या पेंसिल बना सकते हो?
यह निष्कर्ष निकालने में छात्रों की सहायता कीजिए कि केवल सजीव वस्तुएं ही अपने समान जीवों का जनन कर सकती है, निर्जीव वस्तुए नही।

विस्तारण 1

एक ही जाति के दो अलग-अलग गमलो मे लगे पौधे लेकर 'अ' तथा 'ब' से नामांकित कीजिए। गमला 'ब' को क्षैतिज दिशा में और गमला 'अ' को उर्ध्वाधर दिशा मे रखें और दो सप्ताह बाद छात्रो से कहिए कि निरीक्षण करे।

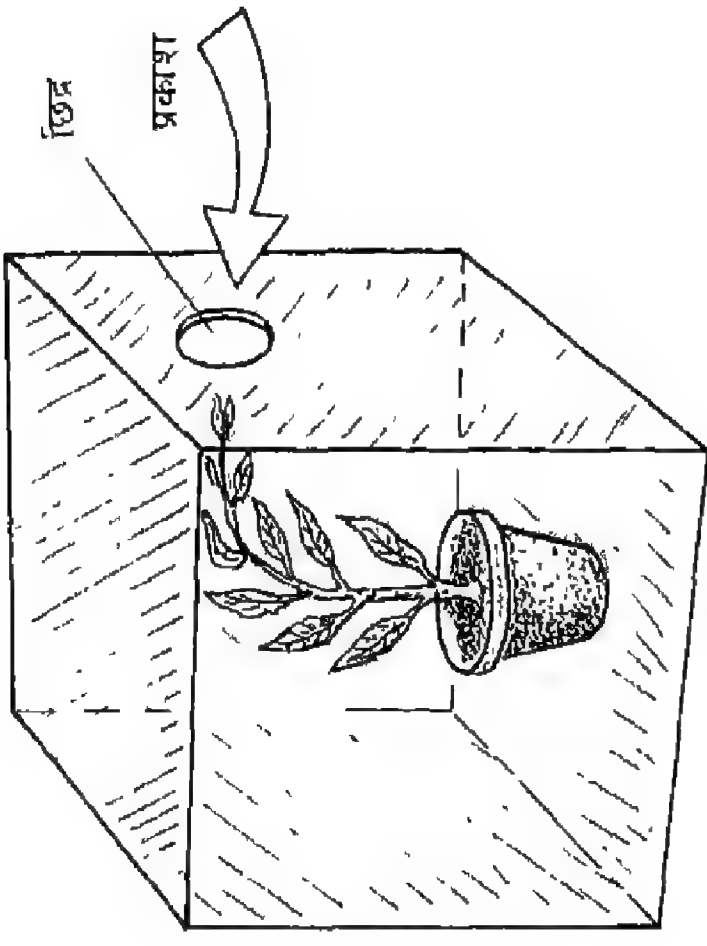
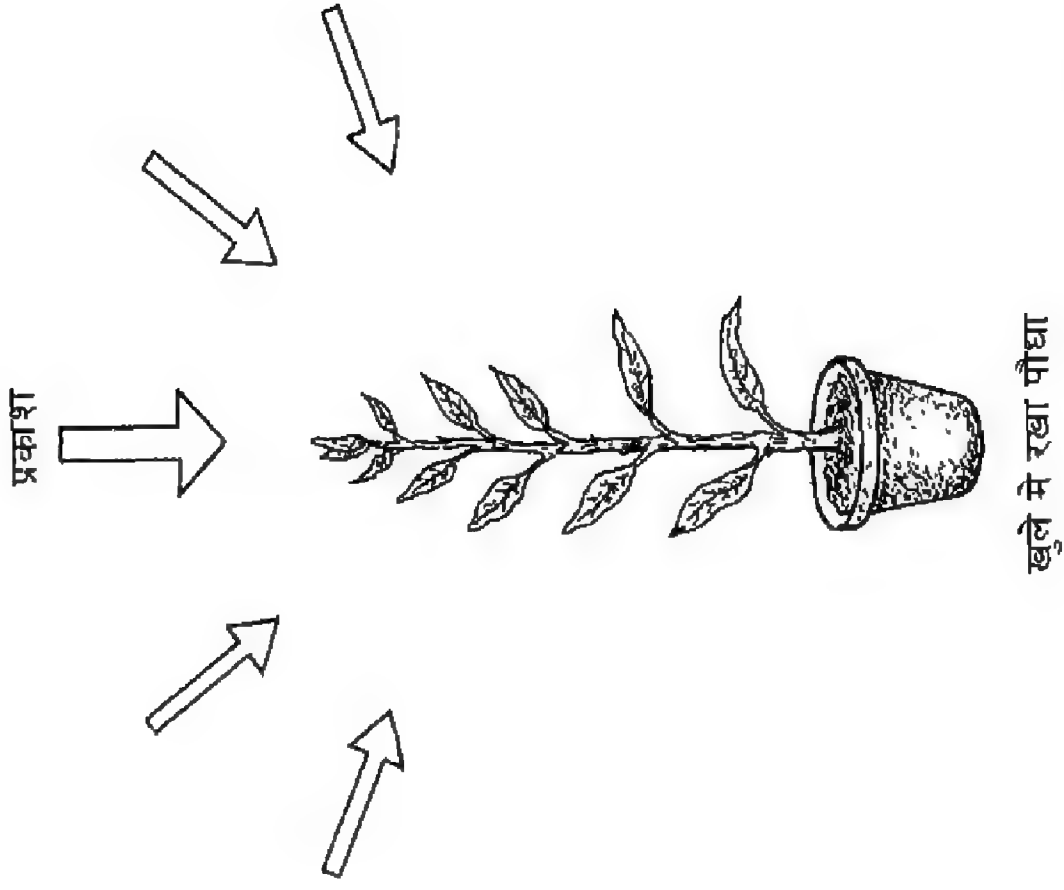
गमले मे लगे दो समान पौधे

उनसे पूछिए:
गमला 'ब' का पौधा किस दिशा मे मुड़ गया है?
गमला 'अ' का पौधा सीधा उर्ध्वाधर दिशा मे क्यो बढ गया है?
इस क्रियाकलाप से तुम क्या परिणाम निकालते हो?

(पौधो के वायवीय भागों मे पृथ्वी के गुरुत्वाकर्षण के विपरीत वृद्धि करने की प्रकृति होती है)

गुरूत्व के विपरीत पौधो के वायवीय भागो की वृद्धि

विस्तारण 2

चना/मूंग/सेम आदि की बीजों को दो विभिन्न गमलों में अंकुरित कराइए।
एक गमले को ऐसे स्थान में रखिए जहा सभी ओर से प्रकाश मिलता हो।
दूसरे गमले को एक ओर छिद्र वाले कार्ड बोर्ड के बक्स मे कुछ दिन के लिये रखिये।

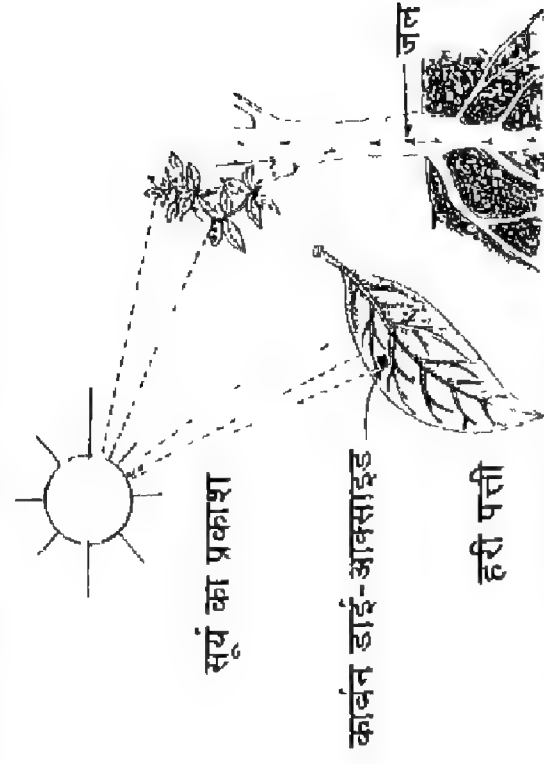
दो गमले, कार्ड बोर्ड बक्स, चना, मूग/सेम

प्रकाश के प्रति पौधे की अनुक्रिया

दोनो पौधों को नियमित पानी देते रहिए।
कुछ दिन बाद छात्रो से कहिए कि दोनो पौधों का निरीक्षण करे।

(पौधों का प्रकाश के प्रति अनुक्रिया प्रदर्शित करने का प्रयोग)

1.2: पौधो और जन्तुओं में किस प्रकार भिन्नता है?
केंद्रित करें: पौधो और जन्तुओं में अन्तर

(कालाश 4-5)

अधिगम परिणाम	प्रस्तावित शिक्षण प्रक्रम	साधन एव सामग्री
	क्रियाकलाप 1	
पौधो और जन्तुओं मे अतर बताने वाले लक्षणो का ज्ञान कराना	छात्रों के पूर्वज्ञान को पुन: स्मरण कराइए, उनसे पूछिए: पौधो के उन भागो के नाम बताइए जो उनके भोजन बनाने मे सहायक हो। पत्तिया हरी क्यों होती है? (हरे रग (पर्णहरित) की उपस्थिति के कारण) पौधे भोजन बनाने के लिए कौन-कौन से पदार्थ उपयोग करते हैं? (जल, कार्बन डाईआक्साइड, पर्णहरित एव सूर्य का प्रकाश)	

हरी पत्तियां सूर्य के प्रकाश मे पौधे के लिए भोजन बनाती है

यह निष्कर्ष निकालने में छात्रो की सहायता कीजिए कि पौधे अपना भोजन सूर्य के प्रकाश में पर्ण हरित, जल एवं कार्बन-डाई आक्साइड की सहायता से बनाते हैं।

यदि इनमें से कोई भी घटक अनुपस्थित रहता है, तो पौधे अपना भोजन नहीं बना सकते हैं।
हमे अपना भोजन कहां से प्राप्त होता है?
(पौधे/जन्तु)
किन जन्तुओं से आपको दूध प्राप्त होता है?
(बकरी, गाय एवं भैंस)
किन जन्तुओ से आपको मांस; तथा अण्डे प्राप्त होते है?
(भेड, बकरी, मुर्गी)

बकरी

भेड़

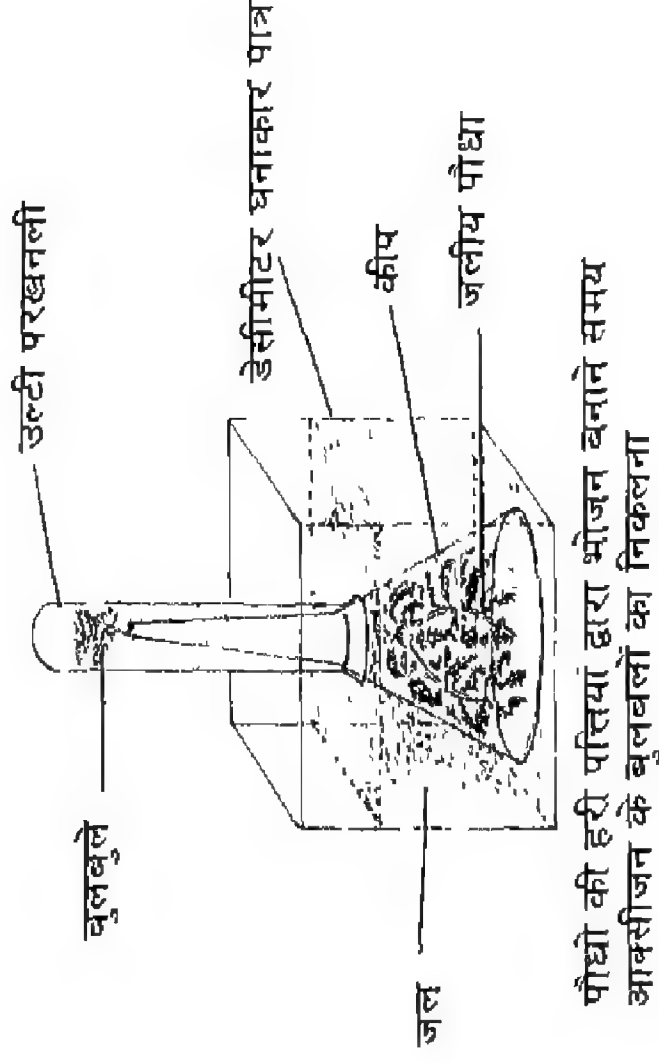
मुर्गी

गाय, भैंस, बकरी आदि जन्तु अपना भोजन कहा से प्राप्त करते है?
(पौधो से)
शेर, चीता, भेड़िया आदि जानवर क्या खाते हैं?
(हिरण, भेड़, तथा अन्य जन्तुओं का मांस)
यह निष्कर्ष निकालने में छात्रों की सहायता कीजिए कि जन्तु अपने भोजन के लिए प्रत्यक्ष एवं अप्रत्यक्ष रूप से पौधो पर आश्रित रहते है, जो कि पेड़ पौधों और जन्तुओ में प्रमुख अंतर है। पौधो में एक प्रकार का विशेष हरा पदार्थ ''पर्णहरित'' पाया जाता है, जो पौधों को सूर्य के प्रकाश, जल एवं कार्बनडाई-आक्साइड की उपस्थिति मे भोजन बनाने में सहायक है जिसके फलस्वरूप आक्सीजन गैस निकलती है।

क्रियाकलाप 2

छात्रो से कहिए कि पानी से तीन चौथाई भाग तक भरे डेसीमीटर घनाकार पात्र लीजिए। एक जलीय पौधा (पौधे जो जल मे उगते है जैसे हाइड्रिला, सेरेटोफिलम, आदि) लीजिए इस पौधे को पानी से भरे पात्र में उल्टी कीप के नीचे इस प्रकार रखिए जैसे चित्र में प्रदर्शित है। अब पानी से भरी एक परखनली लीजिए। अपना अगूठा परखनली के मुख पर रखकर कीप के ऊपर चित्र के अनुसार रखिए। अब उपकरण को सूर्य के प्रकाश मे रखकर एक घटे के पश्चात् निरीक्षण कीजिए।
(अच्छे परिणाम के लिए पानी में सोडियम बाईकार्बोनेट मिला सकते हैं)

डेसीमीटर घनाकार पात्र, कीप, परखनली, पानी, जलीय पौधे (हाइड्रिला, या अन्य कोई जल-निमग्न पोधा)

पौधो की हरी पत्तियां द्वारा भोजन बनाने समय आक्सीजन के बुलबलों का निकलना

उनसे पूछिए.
वायु के बुलबले निकलने का स्रोत क्या है?
(हरे पौधे)
छात्रों से कहिए कि वे हरे पौधो के स्थान पर जड या पौधे के किसी अहरित भाग को लेकर एक-दो घण्टे के पश्चात निरीक्षण करें।

उनसे पूछिए:
तुम क्या निरीक्षण करते हो?
(वायु के बुलबुले नहीं निकलते)
छात्रों द्वारा निरीक्षण के आधार पर उन्हें यह निष्कर्ष निकालने में सहायता कीजिए कि पौधों को भोजन बनाने के लिये हरा पदार्थ-पर्णहरित, आवश्यक है। यह जल तथा कार्बनडाइ-आक्साईड के साथ सूर्य के प्रकाश मे भोजन बनाने मे सहायता कर देता है। इसी कारण मनुष्य अपने भोजन के लिए पौधों पर आश्रित रहता है। पौधे सभी जीवों के लिए भोजन प्रदान करने के प्रमुख स्रोत होते हैं।
टिप्पणी-यूग्लीना एक जन्तु है, जिसमें पर्णहरित पाया जाता हैं अतः यह अपना भोजन स्वय बना सकता है।

उनसे पूछिए.
अपने पास-पड़ोस में पाए जाने वाले कुछ पौधों के नाम बताइए।
उनमे से कोन-सा पौधा एक स्थान से दूसरे स्थान तक गति करता है?
उन्हें स्पष्ट रूप से समझाइएं कि अधिकतर पौधे एक स्थान से दूसरे स्थान तक गति नहीं करते हैं जबकि जन्तु सामान्य रूप से एक स्थान से दूसरे स्थान तक गति करते हैं। कुछ समुद्री जन्तु जैसे सीफेदर, सीपेन, मूंगा आदि स्थिर रहते हैं, अचल होते हैं।
इसी प्रकार बहुत से पौधे गति नहीं करते हैं। लेकिन कुछ जलीय पौधे जैसे क्लोमाइडोमोनास, वॉलवॉक्स, आदि गति करते है।
उनसे कहिए कि पौधों तथा जन्तुओ के अन्तर की सूची बनाए।

विस्तारण 1

छात्रो से कहिए कि पास-पड़ोस में पाए जाने वाले पांच पौधो तथा जन्तुओं के चित्र एकत्र करके स्क्रेप बुक में लगाए।

स्क्रेप बुक पाच पौधे तथा जन्तुओ के चित्र, गोद

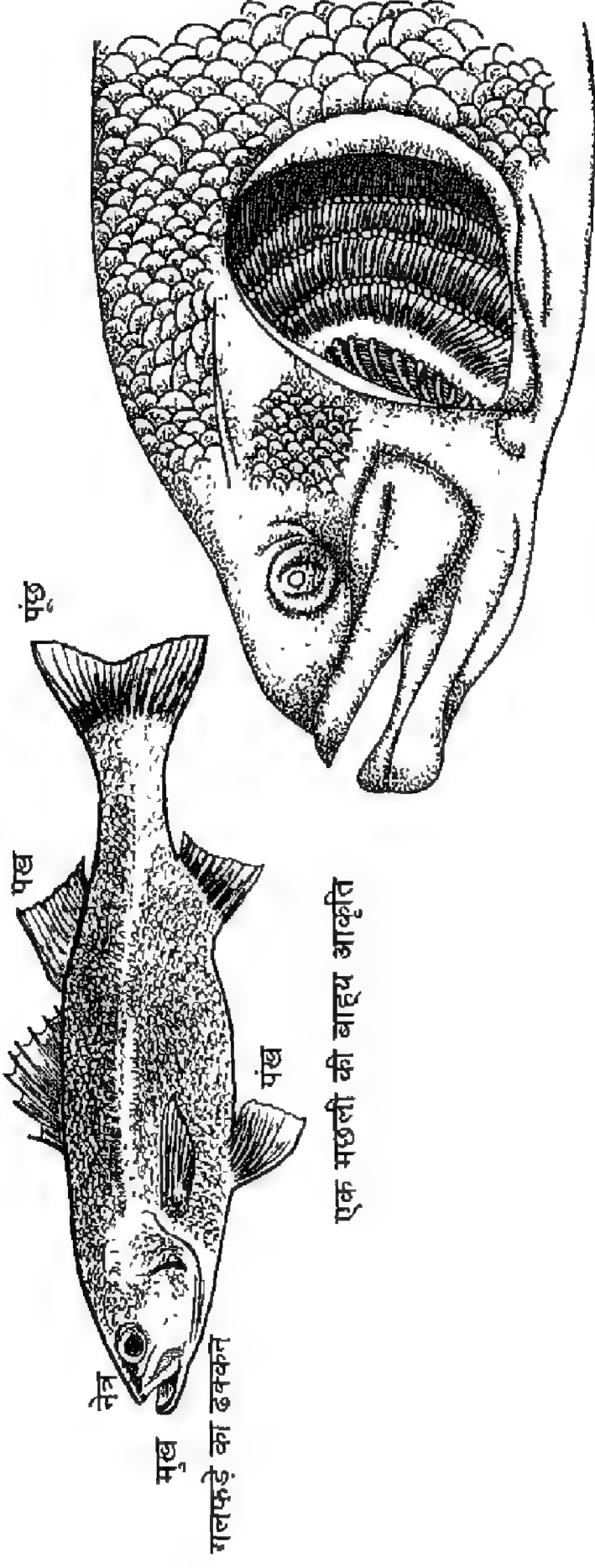
विस्तारण 2

छात्रो से कहिए कि सारणी भरें।

सजीव वस्तुए	पौधे	जन्तु	गति कर सकते है	गति नहीं कर सकते हैं	भोजन स्रोत	
					पौधे	जन्तु
बकरी	×	✓	✓	×	✓	×
गुलाब						
तोता						
तुलसी						
तितली						
कमल						

1.3: पौधे तथा जन्तु अपने आप को पर्यावरण के अनुसार कैसे अनुकूलित करते है?
केंद्रित करें: पौधो तथा जन्तुओं की रचना, उनके पर्यावरण के अनुसार

(कालांश 6-7)

अधिगम परिणाम	प्रस्तावित शिक्षण प्रक्रम	साधन एवं सामग्री
	क्रियाकलाप 1	
जलीय पौधों तथा जन्तुओं के विशेष लक्षणों की पहचान कराना	एक मछली का नमूना/चार्ट दिखलाइए। उनसे पूछिए: ये कहा रहती है? छात्रों से पानी मे रहने वाले अन्य जन्तुओ के नाम पूछिए। मछली गति कैसे करती है? मछली श्वास कैसे लेती है? (गलफड़ों द्वारा) मछली के शरीर की आकृति कैसी होती है? (धारा रेखित आकार; धारा रेखित आकार अथवा नाव के आकार की, जिसके दोनो किनारे नुकीले तथा बीच से चौड़े होते है)	चार्ट, मछली के गलफड़ों को प्रदर्शित करने वाला एक सजीव मछली/मछली के बाहय आकार का चार्ट

एक मछली की बाह्य आकृति

गलफडों के ढक्कन निकालने के बाद

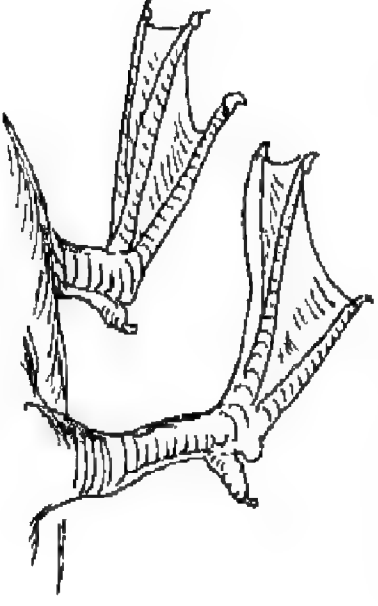
छात्रों को निष्कर्ष निकालने में सहायता कीजिये कि गलफडे, पख तथा धारा रेखित आकार, मछली को पानी में रहने योग्य बनाती है।

क्रियाकलाप 2

जमीन पर कूदते हुये तथा पानी में तैरते हुए मेढ़क का चित्र दिखलाइए। एक या दो छात्रों से कहिए कि मेढ़क की तरह कूदे।

मेढक के बाह्य आकार तथा कूदते हुए मेढक का चार्ट

उनसे पूछिए:
मेढ़क की कौन-सी रचना पानी मे रहने मे सहायक है?
(चिकनी त्वचा तथा जालयुक्त पैर)
मेढक पानी में कैसे श्वसन करते हैं।
(त्वचा द्वारा)
मेढ़क के शरीर का कौन-सा भाग पानी में तैरने में सहायक होता है?
(जालयुक्त पैर)

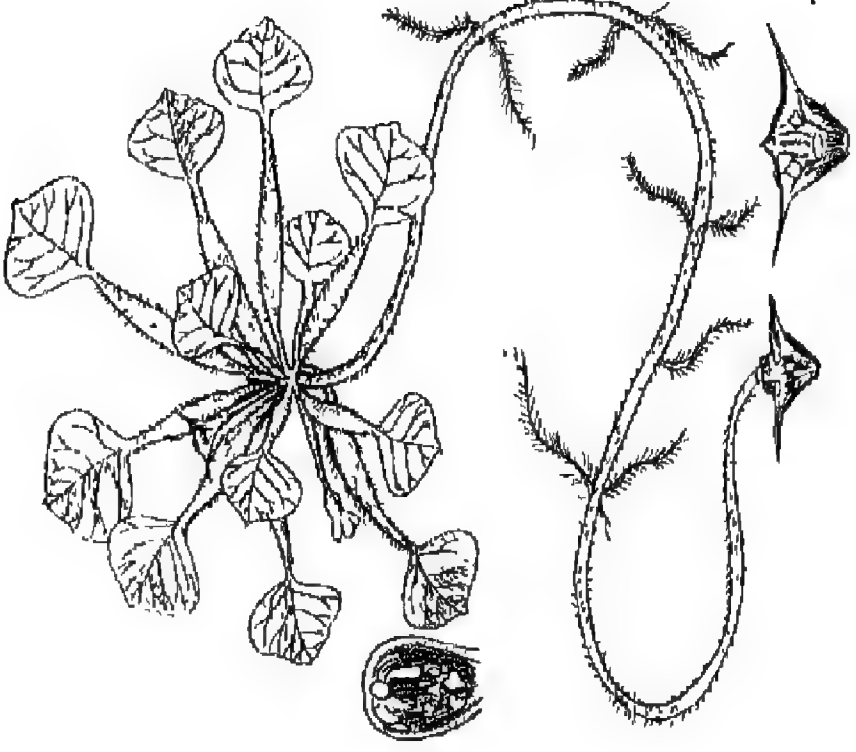
टोड

एक बतख के जाल युक्त पाद

मेढक का कौन-सा भाग भूमि मे कूदने में सहायक होता है?
(पश्चपाद)
बतख पानी में कैसे तैरती है?
(जाल युक्त पाद)
क्या होता है जब तुम एक मेढक को पकड़ने का प्रयास करते हो?
यह क्यों फिसल जाता है?
यह निष्कर्ष निकालने में छात्रों की सहायता कीजिए कि पिछले लम्बे पैर, जालयुक्त पैर और चिकनी नमयुक्त त्वचा द्वारा मेढक जल तथा स्थल मे रहने के लिए अपने को अनुकूलित कर लेता है।

क्रियाकलाप 3

छात्रो से पूछिए कि कमल कहा उगता है?
कुछ जलीय पौधो (कुछ जल प्लावी तथा कुछ जल निमग्न पौधे) तथा स्थलीय पौधों के जडों, तनों तथा पर्णवृन्तों के अनुप्रस्थ काट के चित्रो के चार्ट दिखाइए।

चार्ट-जलीय पौधों जैसे हाईड्रिला सिंघाड़ा

हाइड्रिला

सिंघाड़ा

उनसे पूछिए:

स्थलीय तथा जलीय पौधो के तनों के अनुप्रस्थकाट में तुम्हें क्या अन्तर दिखाई देता है?
तुम्हें स्थलीय तथा जलीय पौधों के पर्णवृन्तों के अनुप्रस्थ काट के क्या अन्तर मिलता है?
यह निष्कर्ष निकालने मे छात्रों की सहायता कीजिए कि स्पज के समान जलीय पौधों के जड़, तना तथा पत्तियो में वायु गुहाएं होती है जो पौधे को प्लावी बनाती है।

कमल के फल को पानी में तैरने मे क्या सहायक हैं?
(फल में अत्यधिक संख्या में पाये जाने वाले वायु गुहायें)

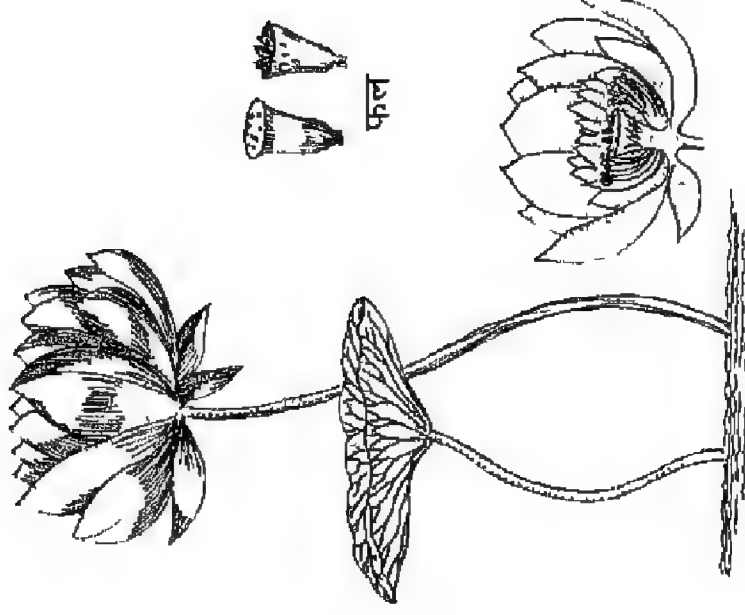
कमल का पौधा

क्रियाकलाप 4

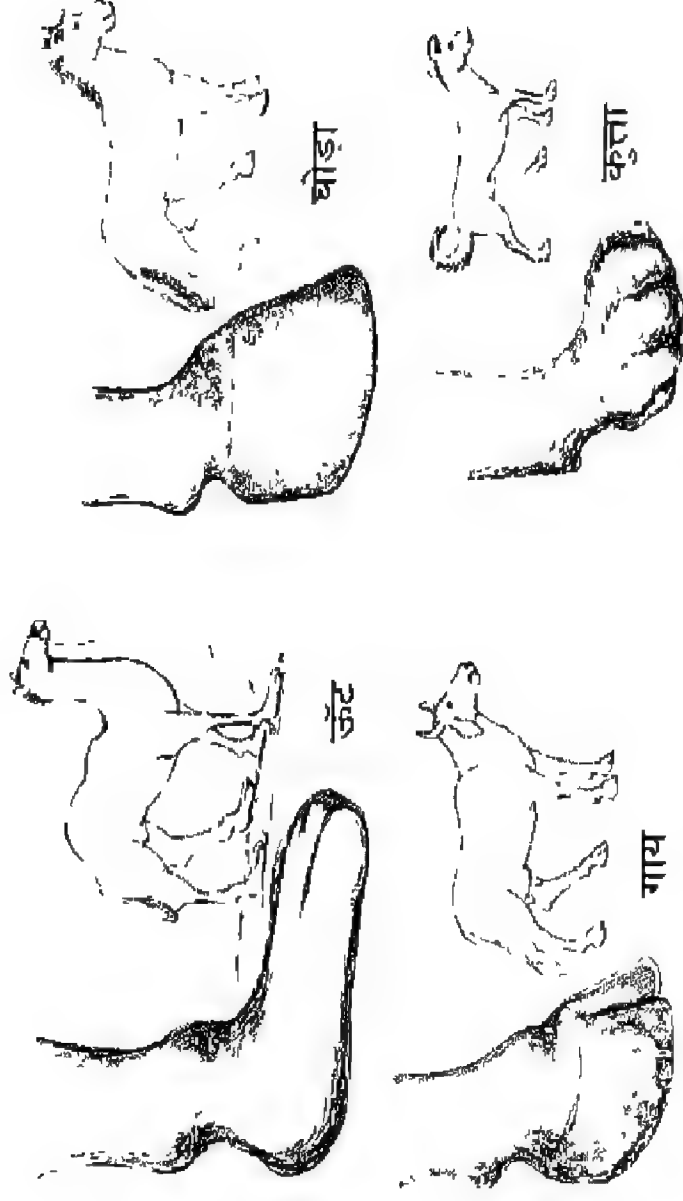
रेगिस्तान मे रहने वाले पौधे तथा जन्तुओ के विशेष लक्षणो की पहचान कराना

ऊंट का चार्ट

रेगिस्तान में रहने वाले कुछ जानवर जैसे ऊंट का चार्ट दिखाइए।

उनसे पूछिए:
रेगिस्तान मे पाये जाने वाले कुछ जन्तुओं के नाम बताइए।
तुम ऊंट में किस प्रकार के पैर देखते हो?
(लम्बे गद्देदार पैर)
इसके पैर घोड़ा, गाय तथा कुत्ते से किस प्रकार भिन्न होते है?
क्या ये जानवर (घोड़ा, गाय तथा कुत्ता) रेगिस्तान पर आसानी से दौड सकते हैं?
ऊंट रेगिस्तान में रेत पर आसानी से क्यों दौड़ सकता है?
ऊंट को रेगिस्तान का जहाज क्यों कहते हैं?
(यह रेगिस्तान मे माल ढोने तथा यातायात का प्रमुख साधन है)

गाय, घोड़ा, कुत्ता तथा ऊंट आदि के पैर प्रदर्शित करने वाला चार्ट

ऊँट

ऊंट रेगिस्तान में कई दिनों तक बिना पानी के कैसे रहता है?
(उसके शरीर की पृष्ठ सतह पर पानी की एक थैली होती है)
यह निष्कर्ष निकालने में छात्रों की सहायता कीजिए कि ऊंट की ये सभी रचनाएं उसे रेगिस्तान में रहने योग्य बनाती हैं।

विभिन्न जन्तुओ के पाद

क्रियाकलाप 5

छात्रों से कहिए कि वे दो गमले लें। एक में नागफनी तथा दूसरे में कोई बगीचे वाला पौधा लगाएं। उन्हे क्रमशः 'अ' तथा 'ब' से चिन्हित करे। दोनो गमलों को सूर्य के प्रकाश मे रखकर, पानी न दें। दो सप्ताह बाद निरीक्षण के लिए कहिए।

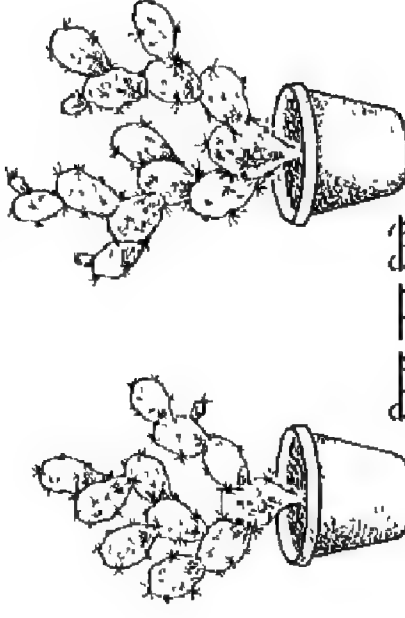
दो गमले मे लगे पोधे (नागफनी, कोई अन्य पोधा, जैसे सदाबहार, गुल मेहदी तथा कोलियस, आदि)

उनसे पूछिए:

कौन-सा पौधा सूख गया है?

'अ' गमले का पौधा (नागफनी) क्यों नहीं सूखा?

यह निष्कर्ष निकालने मे उनकी सहायता कीजिए कि वे पौधे जो रेगिस्तान मे उगते हैं उनमें हरे चपटे मांसल स्तम्भ होते है, उनकी पत्तियां काटो के रूप मे रूपान्तरित हो जाती हैं जिससे वाष्पोत्सर्जन (जल हानि) नियंत्रित होता है। हरे चपटे स्तम्भ भोजन बनाते हैं तथा जल संग्रह करते है।

स्पष्ट कीजिए कि मरूद्भिद पौधे जैसे नागफनी, जल हानि को रोकने के लिये विशेष प्रकार से

अनुकूलित होते है जब कि अन्य पौधों मे ऐसा नही होता है। ये विशेष लक्षण पौधो का मरूद्भिद परिस्थितियों के अनुकूल बनाती है।

क्रियाकलाप 6

पहाड़ों पर पाए जाने वाले पौधों तथा जन्तुओं के विशेष लक्षण की पहचान कराना

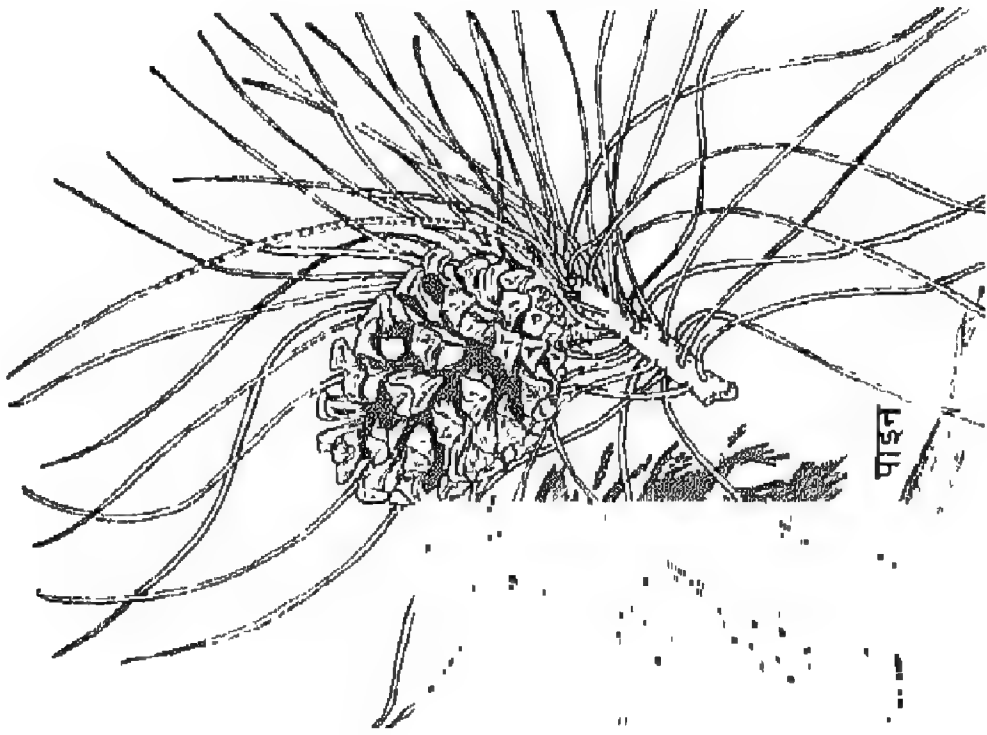
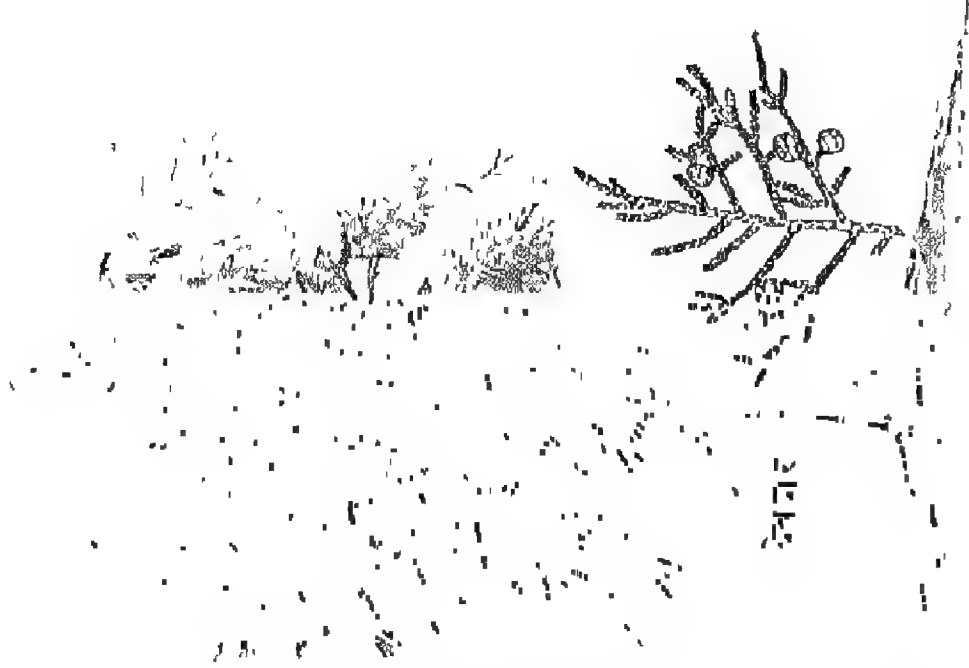
पहाड़ों की ठण्डी जलवायु में पाए जाने वाले कुछ जन्तुओं एव पोधो के चार्ट दिखाइए।

चीड़, देवदार का चार्ट, भेड़ तथा याक का चार्ट

उनसे पूछिए:
इन जन्तुओं का कौन-सी शारीरिक रचना उनको ठण्ड से बचाने में सहायता करती है?
(त्वचा का मोटी स्तर तथा घने बाल)
मैदान तथा पहाड़ों पर उगने वाले पौधों की पत्तियो के संरचना मे तुम्हे क्या अन्तर दिखाई देता है?

यह निष्कर्ष निकालने में उनकी सहायता कीजिए कि बहुत से जन्तु जैसे भेड तथा याक, आदि को ठण्ड से बचने के लिए उनके शरीर में बालों का घना आवरण होता हैं। बहुत से पौधो जैसे चीड़, देवदार आदि की पत्तिया सुई के समान होती है।

पत्तियो की सुई के समान सरचना, तेज हवाओ के प्रति कम अवरोध उत्पन्न करती हैं।

पाइन

भेड

याक

पर्वतीय क्षेत्रो के कुछ पौधे और जन्तु

क्रियाकलाप 7

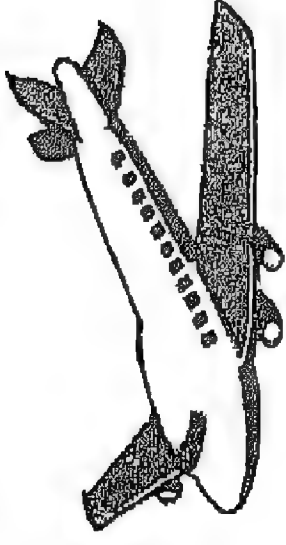
उड़ने वाले जन्तुओ के लक्षणो को पहचानना

एक उड़ती हुई चिड़िया का नमूना/चार्ट दिखाइए।

उनसे पूछिए:
कुछ जन्तुओ के नाम बताइए जो हवा में उडते है?
(पक्षी तथा चमगादड़, आदि)
तुम बिना किसी बाहय सहायता के क्यों नहीं उड़ पाते हो?
चिडिया को हवा में उडने के लिए कौन-सी शारीरिक संरचनाएं सहायक है?
(पंख तथा हल्का शरीर)
चिड़िया तथा जहाज की आकृति मे क्या समानताएं हैं?
(दोनो का शरीर धारा रेखित होता है अर्थात आगे तथा पीछे सकरा तथा बीच में चौड़ा, या हम नौका कार कह सकते हैं)
यह निष्कर्ष निकालने मे उसकी सहायता कीजिए कि चिड़ियों में विशेष शारीरिक सरचनाएं जैसे पर, पंख तथा धारा रखित हल्का शरीर, उसे उड़ने में सहायक होते है।

कुछ उडती चिडियो के बाहय सरचनाओ को प्रदर्शित करने वाला चार्ट

एक जहाज तथा एक उडती चिडिया का चार्ट

उड़ती चिडिया

वायुयान

विस्तारण 1

छात्रो से कहिए कि अपने पास-पड़ोस में पाए जाने वाली चिडियां, मछलियां, ऊंट तथा भेड़ की गतियो का निरीक्षण करें।

विस्तारण 2

छात्रो से कहिए कि जलीय पौधे, नागफनी, ताड के पेड़ तथा अन्य स्थलीय पौधों का निरीक्षण करे और उनकी विशिष्ट अनुकूलताओं के साथ उनके आवास/जन्तु तथा पौधे का प्राकृतिक घर को, लिखें।

विस्तारण 3

छात्रों को प्रोत्साहित कीजिए कि अनुच्छेद 3 में दिए गए निर्देशों के अनुसार टेरेरियम बनाए। उनसे कहिए कि वे छोटे-छोटे जन्तु जैसे केंचुआ, घोघा, मेढक, आदि की गतियों का निरीक्षण करें।

1.4: क्या एक पौधे के सभी बीज नये पौधे उत्पन्न करते है?
केंद्रित करें: सभी बीज पौधे नहीं बनाते

(कालाश 2-3)

अधिगम परिणाम	प्रस्तावित शिक्षण प्रक्रम	साधन एव सामग्री
पहचानना कि एक पौधे के सभी बीज समान प्रकार के पौधे उत्पन्न नही करते	क्रियाकलाप 1 उनसे पूछिए. एक वृक्ष के सभी बीजों को नये पौधे बनने का अवसर क्यों नही मिलता है? यह समझने में उनकी सहायता कीजिए कि एक पौधे से बहुत से बीज उत्पन्न होते हैं लेकिन सभी बीज अकुंरित होकर नए पौधे नहीं बन पाते हैं। क्योंकि बहुत से बीज प्राकृतिक माध्यम जैसे हवा, जल आदि द्वारा नष्ट हो जाते हैं। जबकि अन्य बीज, जन्तु तथा कीटो द्वारा खा लिए जाते है या नष्ट कर दिए जाते है। छात्रों से कहिए कि वे सरसों, चना, सेम के गिनती के बीज लेकर भूमि में या गमलों मे अलग-अलग बोएं।	मिट्टी, सरसों, चना तथा सेम के बीज

बीजो को अंकुरित होकर शिशु पौधे मे और शिशु पौधे से तरूण पौधे में वृद्धि करने दे।
छात्रों से कहिए कि वे एक समूह के पौधे जैसे चना या सेम के बाह्य लक्षणों को दूसरे समूह के पौधो जैसे सरसों के बाहय लक्षणो को देखे और तुलना करें। वे एक ही प्रकार के पांच छः पौधो (जैसे सरसों) को देखें उनकी उन समानताओं को लिखे जो अन्य पौधो के लक्षणों को भी व्यक्त करती हैं।

उनसे पूछिए:
एक समूह के पौधे दूसरे समूह के पौधों से किस प्रकार भिन्न हैं?
एक-ही समूह के पौधे किस प्रकार समान दिखाई देते है?
एक-ही समूह के पौधों मे तुम्हें कौन-सी समानता दिखाई देती हैं?
यह निष्कर्ष निकालने में छात्रों की सहायता कीजिए कि पौधे के बीज समान प्रकार के पौधे उत्पन्न करते हैं।

विस्तारण 1

'अ' और 'ब' दो गमले लीजिए।

दो गमले, सेम, मक्का के बीज

'अ' गमले में कुछ सेम, मक्का या अन्य वातावरण में मिलने वाले स्वस्थ बीजों को बोइए और 'ब' गमले मे उसी प्रजाति के अक्षम/क्षतिग्रस्त बीजो को वोइए।
दोनों को नियमित पानी दीजिए और 10-15 दिन बाद उनकी वृद्धि का निरीक्षण कर परिणाम की चर्चा कीजिए।

विस्तारण 2

एक गमले मे चना, सरसों एवं सेम के पांच-पांच बीज बोइए।

चना, सेम, सरसो के बीज

उन्हें नियमित पानी दीजिए और 10-15 दिनों बाद उनकी वृद्धि का निरीक्षण कीजिए ओर क्रियाकलाप 1.4.1 में पूर्व में बोए गए उन्ही पौधों की रचना से तुलना कीजिए।
परिणाम की चर्चा कीजिए।

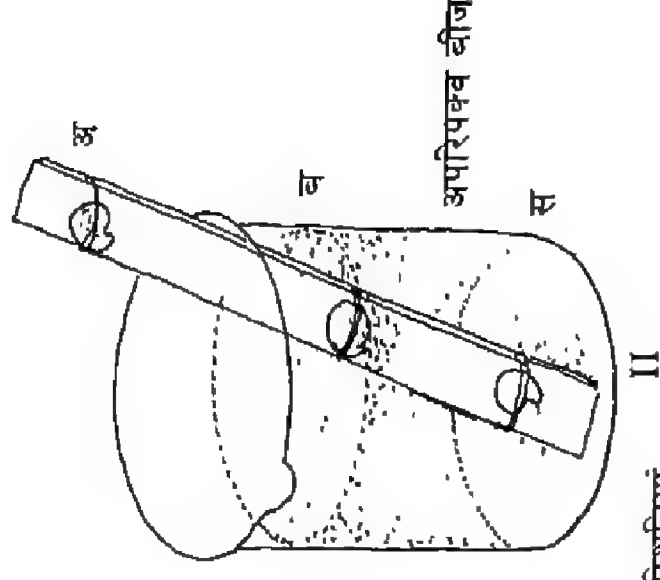
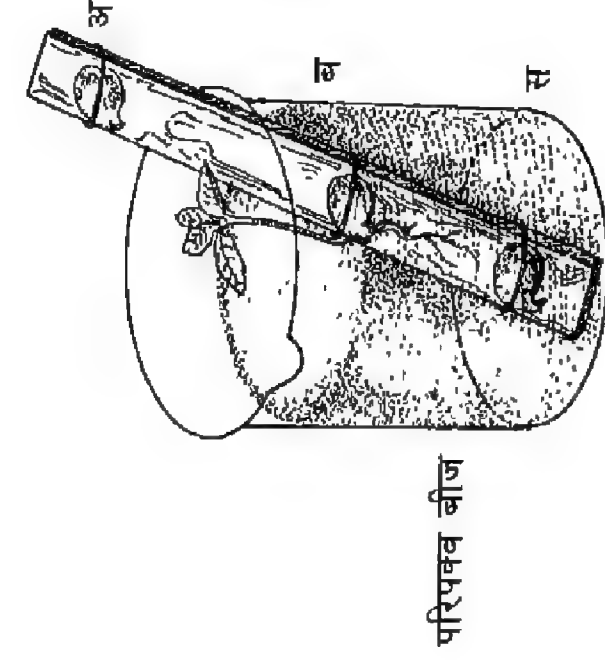
1.5: अंकुरण के लिए आवश्यक परिस्थितियां कौन-कौन सी हैं?

केंद्रित करें: अंकुरण के लिए आवश्यक परिस्थितियां

(कालांश 2-3)

अधिगम परिणाम	प्रस्तावित शिक्षण प्रक्रम	साधन एवं सामग्री
	क्रियाकलाप I	
अंकुरण के लिए आवश्यक परिस्थितियों का ज्ञान कराना	छात्रें से पूछिए: सेम के तीन परिपक्व (स्वस्थ) और तीन अपरिपक्व (अस्वस्थ) बीज लीजिए। स्वस्थ परिवक्व तथा अस्वस्थ अपरिपक्व बीजो को पहचानने के लिए सभी बीजों को पानी से भरे एक बीकर में रखिए। अस्वस्थ बीज पानी मे तैरेंगे और स्वस्थ बीज पानी मे नीचे बैठ जायेंगे। चित्र के अनुसार उन्हे लकड़ी या प्लास्टिक के स्ट्रिप पाइप मे डोरे या रवर बैण्ड की सहायता से लगाइए जिस बीकर में स्वस्थ बीज हो उसे 1 से और जिसमे अस्वस्थ बीज हो उसे II से चिन्हित कीजिए।	3 स्वस्थ और 3 अस्वस्थ सेम के बीज, रबरबेण्ड धागा लकडी की स्ट्रिप, दो बीकर, उबाल कर ठण्डा किया गया पानी, तेल

परिपक्व बीज — अ, ब, स — I

अपरिपक्व बीज — अ, ब, स — II

अंकुरण के लिए आवश्यक परिस्थितियां

उबाल कर ठण्डे किए गए पानी से भरे (पानी में घुली हुई वायु को निकालने के लिए) बीकरों में बीज से लगी लकड़ी की स्ट्रिप रखिए। दोनों बीकरों में पानी की सतह बीच वाले बीजों को छूती रहे। बीजों को ऊपर से नीचे की ओर अ,ब,स से नामांकित करे। पानी की सतह पर तेल की कुछ बूंदें डाल देते हैं, जिससे पानी का वाष्पीकरण न हो सके तथा बाहर की वायु इसमें प्रवेश न करे सके।

उपकरण को 6-7 दिनों के लिए यथावत छोड़ दे और तत्पश्चात् बीजो में होने वाले परिवर्तनो का निरीक्षण करे।

उनसे पूछिए:
बीकर I मे 'अ' बीज अंकुरित क्यों नही हुआ?
(जल की अनुपस्थिति के कारण)
बीकर I मे 'ब' बीज अंकुरित क्यों हुआ?
(उचित ताप, वायु तथा जल की उपस्थिति के कारण)
बीकर I में 'स' बीज क्यों नही अंकुरित हुआ?
(वायु की अनुपस्थिति के कारण)
बीकर II के सभी बीजो में अंकुरण क्यों नहीं हो पाया?
(अस्वस्थ एवं अपरिपक्व बीजो के कारण)
यह निष्कर्ष निकालने मे उनकी सहायता कीजिए कि उचित ताप, वायु एवं जल, बीजो के अंकुरण के लिए आवश्यक हैं और केवल स्वस्थ एवं परिपक्व बीजो का ही अंकुरण होता है।

विस्तारण 1

छात्रों को प्रोत्साहित कीजिए कि इसी प्रकार से दूसरे क्रियाकलाप करें जिसमे दूसरे प्रकार के स्वस्थ (परिपक्व) तथा अस्वस्थ (अपरिपक्व) बीजों को ले और उबाल कर ठण्डे पानी के स्थान पर साधारण पानी लें। तेल की बूदें भी न डालें लेकिन पानी की सतह एक-सी बनाए रखने के लिए समय-समय पर पानी डालें। यदि आवश्यकता हो। उपकरण को एक सप्ताह तक रखे और बीजों में होने वाले परिवर्तनों का निरीक्षण करके परिणाम की आपस में चर्चा करें।

विस्तारण 2

चार कटोरी खाली डिब्बे या अन्य कोई बर्तन लेकर 'अ', 'ब', 'स', तथा 'द' से नामांकित कीजिए। चारों बर्तनो में रूई/मलमल का कपड़ा/अखबार/सोखता या छनना कागज रखिए और उनमे कुछ

	सेम/चना/मूंग आदि के बीजों को रखिए। 'अ' बर्तन को आवश्यकतानुसार गीला कीजिए जिससे उसके बीजों को उचित पानी, वायु एवं उपयुक्त ताप मिलता रहे। 'ब' बर्तन में पानी मत डालिए और अन्य परिस्थितियां उसी प्रकार रहने दीजिए। 'स' बर्तन में अधिक पानी डालिए और तेल की बूंदे भी डालिए। जिससे वायु मंडल की वायु प्रवेश न करे सके। 'द' बर्तन गीला कर रेफ्रीजरेटर में या अन्य ठण्डे स्थान में रखिए, जिससे बीजों को उचित ताप न मिल सके। कुछ दिनों बाद सभी चारों बर्तनों मे बीजों के अंकुरण का निरीक्षण कीजिए और जिस बर्तन के बीज अंकुरित हैं उसको लिखिए। जिन बर्तनो में बीजो का अकुरण नहीं हो पाया है, उसकी अप्राप्त परिस्थितियो को लिखिए।	4 कटोरी/खाली डिब्बा, रूई, मलमल, अखबार/छानना कागज सेम, चना, मूग के बीज, पानी

1.6: पौधे की उचित वृद्धि के लिए क्या सूर्य का प्रकाश, खनिज तथा पानी आवश्यक है?
केंद्रित करें: पौधे की वृद्धि के लिए आवश्यक परिस्थितियां

(कालाश 2-3)

अधिगम परिणाम	प्रस्तावित शिक्षण प्रक्रम	साधन एव सामग्री
	- क्रियाकलाप 1	
पौधे की उचित वृद्धि के लिए परिस्थितियो का ज्ञान कराना	छात्रों से कहिए कि एक ही प्रजाति के एक ही आयु के चार तरुण पौधों को लें उनमें से दो पौधों को अलग-अलग 'अ' एव 'ब' गमलो में लगाएं, जिसमे बगीचे की मिट्टी भरी हो। अन्य दो 'स' तथा 'द' गमलो में लगाए जिसमे धुली हुई रेत/छोटे-छोटे पत्थर के कण भरे हों। 'अ' तथा 'स' गमलो को अंधेरे मे और 'ब' तथा 'द' को सूर्य के प्रकाश में रखे। सभी को नियमित पानी दे। 10 दिनों के बाद पौधों की वृद्धि का निरीक्षण करे। उनसे पूछिए: किस गमले के पौधे में स्वस्थ वृद्धि हुई है और क्यो?	चार तरूण पोधे चार गमले, बगीचे की मिट्टी, पानी, पत्थरो के टुकडे ओर रेत

'ब' तथा 'द' गमलो मे किस पौधे में स्वस्थ वृद्धि हुई है और क्यों?
पौधो को नियमित पानी न देने से क्या होगा?

यह निष्कर्ष निकालने मे सहायता कीजिए कि पौधो की उचित वृद्धि के लिए जल, खनिज तथा सूर्य का प्रकाश आवश्यक है।

विस्तारण 1

	दो गमलों में लगे पौधे लीजिए एक गमले को प्रकाश में तथा दूसरे को अंधरे मे रखिए। दोनो को पानी नियमित रूप से दीजिए। एक सप्ताह के बाद दोनो की वृद्धि का निरीक्षण कीजिए। अब पानी देना बंद कर दीजिए और एक सप्ताह बाद वृद्धि का पुन: निरीक्षण कीजिए। परिचर्चा कीजिए।	गमलो मे लगे दो पौधे, पानी

1.7: क्या समान परिस्थितियों मे शिशु पौधो की वृद्धि की दर में भिन्नता होती है?
केंद्रित करें: समान परिस्थितियों में शिशु पौधों की वृद्धि में भिन्नता

(कालाश 2-3)

अधिगम परिणाम	प्रस्तावित शिक्षण प्रक्रम	साधन एव सामग्री
	क्रियाकलाप 1	
समान परिस्थितियो मे एक-ही प्रकार के शिशु पौधो की वृद्धि मे भिन्नता होती है, इस तथ्य से अवगत कराना	छात्रों से कहिए कि वे एक छिछले बर्तन जिसमें बगीचे की मिट्टी भरी हो, मे एक ही प्रकार के कुछ राई/मूग/चना/सेम की बीज बोंए। 4-5 दिन पश्चात शिशु पौधों की लम्वाई देखें। उनसे पूछिए: उनमे क्या अंतर है? क्या सभी शिशु पौधों की लम्बाई (आकार) समान हैं? वे कैसे भिन्न है? यह निष्कर्ष निकालने में उनकी सहायता कीजिए कि एक ही प्रकार की परिस्थितियो मे बीजो में वृद्धि भिन्न-भिन्न होती हैं। क्योंकि एक-ही पौधे के वीजों में खाद्य पदार्थ की मात्रा भिन्न-भिन्न होती है। यह ऐसा एक कारक है जो वृद्धि को प्रभावित करता है।	राई, मूग, चना तथा सेम के बीज, छिछले, चौडे वर्तन

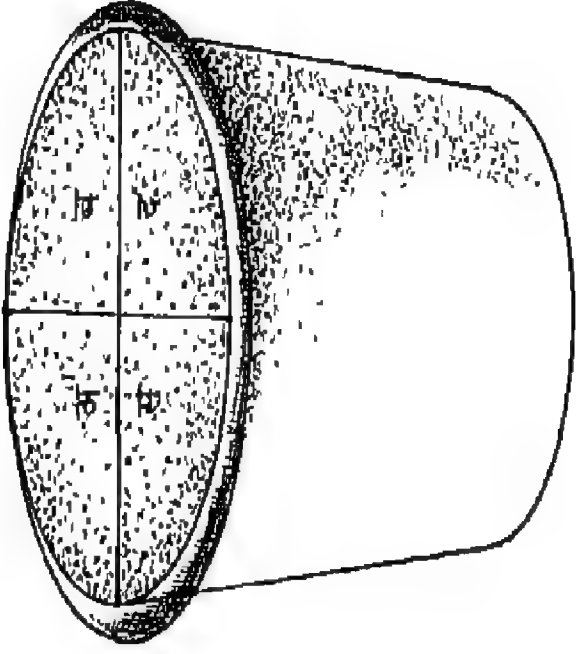
विस्तारण 1

उपर्युक्त प्रयोग एक प्रजाति के अन्य बीज को लेकर कीजिए, जैसे सेम, मटर की अन्य जातियां। निरीक्षण करे और यदि अन्तर हो तो लिखें और चर्चा करें।

सेम, मटर की अन्य जातिया

विस्तारण 2

कुछ चने या अन्य स्वस्थ बीज लीजिए और एक बर्तन में निश्चित दूरियों पर चार स्थानों अ, ब, स, और द पर (चित्र के अनुसार) बोइए। नियमित रूप से पानी दीजिए। वृद्धि का निरीक्षण करिए। चारों शिशु पौधों की लम्बाई की तुलना कीजिए।

पात्र, चने के बीज

इकाई 2: मानव शरीर, पोषण तथा स्वास्थ्य

(अस्थि पंजर; हमारा शरीर और इसकी गति, अभावजनित रोग; संक्रामक रोग; समुदाय स्वच्छता)

प्रस्तावना

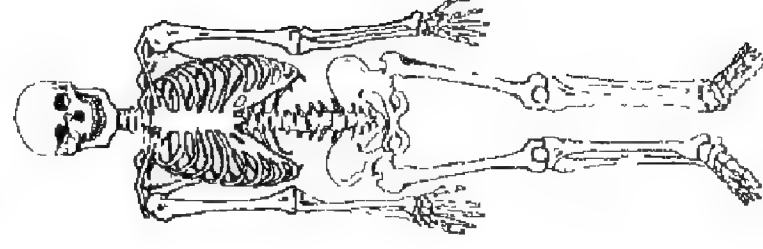
छात्र कक्षा 4 मे, मानव शरीर के महत्वपूर्ण अन्तरागों जैसे फेफड़े, हृदय, आमाशय, यकृत का अध्ययन कर चुके हैं और उनके कार्यो को जानते हैं। छात्र पाचन तंत्र के विभिन्न भागो और पाचन क्रिया की साधारण जानकारी भी प्राप्त कर चुके है। वे भोजन के विविध वर्गो के वर्गीकरण से परिचित हो चुके हैं और भोज्य पदार्थो के संग्रहण, पकाने तथा परोसने, की उचित विधियो के बारे में सीख चुके है। वे भोज्य पदार्थो के संदूषण और उसकी रोकथाम की विधिया जानते हैं। वे अशुद्ध जल की, अशुद्धता के कारणो को तथा जल शोधन के तरीकों से भी अवगत है। वे उन कारणो से भी परिचित हैं, जिनसे पास पडोस (प्रतिवेश) अस्वास्थ्यकर बनता है।

इस इकाई मे छात्र:

— मानव शरीर की विभिन्न अस्थियों को पहचानने मे,
— अस्थियां शरीर को एक निश्चित आकार प्रदान करती हैं तथा कोमल अंगो की रक्षा करती है, यह जानने मे,
— अस्थियो के विभिन्न जोडो की जानकारी प्राप्त करने मे तथा यह जानने में कि इनके कारण शरीर मे गति सम्भव है, यह जानने मे,
— शरीर की पेशियों और उनके प्रमुख कार्यो की जानकारी प्राप्त करने में,
— एच्छिक तथा अनैच्छिक पेशियों और उनके कार्यो की जानकारी प्राप्त करने में,
— पेशियो के उचित विकास के कारको को पहचाने मे, पेशियों के विकास मे व्यायम का महत्व तथा बैठने की सही मुद्रा (आसन) के लाभो को जानने मे,
— मनुष्य के भोजन के अन्तग्रहण का उनकी आयु और उनके व्यवसाय मे सम्बन्ध स्थापित करने में,
— ऊर्जा प्रदान करने वाले, शरीर के निर्माण करने वाले तथा संरक्षात्मक भोज्य पदार्थो की पहचान तथा वर्गीकरण करने में,
— उचित भोजन के अभाव से होने वाली बीमारियों के कारण जानने में और इसी प्रकार की सामान्य बीमारियों विशेषत: रक्ताल्पता तथा नेत्र रोग को पहचानने मे,
— भोजन का समुचित मात्रा मे उपयोग, अभाव जनित रोगो से हमारी रक्षा करता है, जानने में,
— छात्र/छात्राओ मे भोजन की सामान्य आदतें क्या हैं और इसके आधार पर यह स्पष्ट करना कि उचित तथा अनुचित आदते क्या है, यह जानने में,
— भोजन सरक्षण और सग्रह की आवश्यक्ता तथा अनाजों और विभिन्न भोज्य सामग्रियो के सग्रह के उचित तरीकों को पहचानने मे,
— उन कारको को पहचानने मे जो संक्रामक रोगों के प्रसार मे सहायक है,
— अस्वास्थ्यकर स्थितियों के कारण पहचानने में तथा उन्हें रोकने में,
— पर्यावरण की स्वच्छता के लिए किए जाने वाले उपायों को समझने मे, समर्थ होगे।

2.1: मानव शरीर में कंकाल तंत्र के क्या कार्य हैं?
केन्द्रित करें: मानव शरीर में कंकाल तंत्र के कार्य

(कालांश 4-5)

अधिगम परिणाम	प्रस्तावित शिक्षण प्रक्रम	साधन एवं सामग्री
	क्रियाकलाप 1	
मानव शरीर की विभिन्न अस्थियो को पहचानना	छात्रो से कहिए कि वे शरीर में कलाई, हंसली, उंगलियो, चेहरे (खोपडी), पैरों आदि की हड्डियों को स्पर्श द्वारा अनुभव करें। तुम क्या अनुभव करते हो? (हमें अन्दर किसी कड़ी चीज का अनुभव होता है) मानव ककाल का एक चार्ट छात्रो को दिखाइए। यह अनुमान लगाने में छात्रों की सहायता कीजिए कि मानव शरीर विभिन्न प्रकार की अस्थियों से बना है। सम्मिलित रूप से इसे ककाल कहते हैं।	मानव ककाल तन्त्र का चार्ट

मानव ककाल

क्रियाकलाप 2

यह पहचानना कि अस्थिया हमारे शरीर को एक निश्चित आकार प्रदान करती हैं

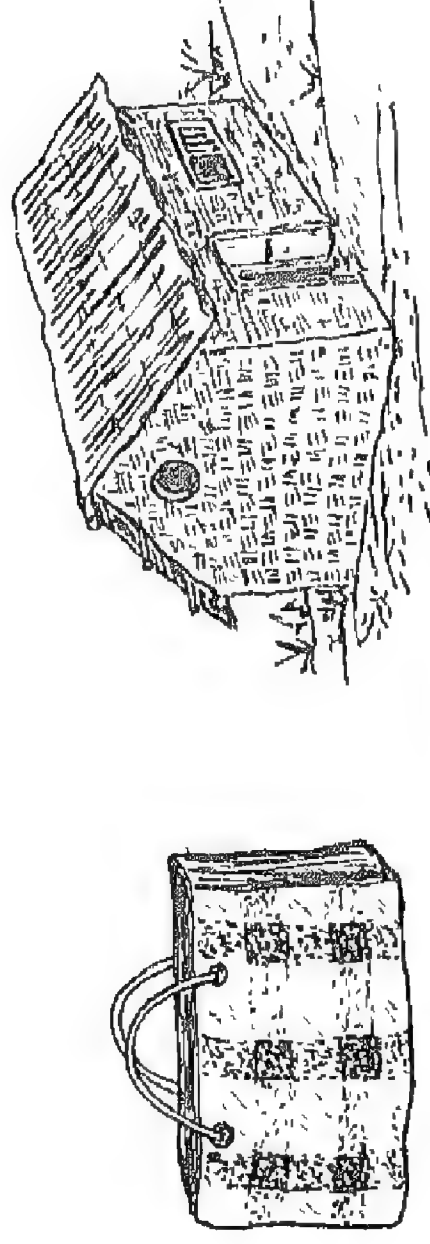
छात्रों से एक कागज के टुकडे पर पेंसिल की सहायता से अपने हाथ की रूपरेखा खींचने को कहिये। छात्रों से कहिए कि वे अपने द्वारा रेखांकित की गयी रूपरेखा को सहपाठी द्वारा खींची गई रूप रेखा से तुलना करें।

कागज, पेंसिल

यह अनुमान लगाने में उनकी मदद कीजिए कि सभी मनुष्यो के आकार की रूपरेखा लगभग एक समान है। यह अवश्य है कि वे आकार में छोटे अथवा बड़े हैं। आकार मे यह समानता उनके शरीर में अस्थियों की उपस्थिति के कारण है।

क्रियाकलाप 3

एक खाली झोला दिखाकर तुलना कीजिए कि यह बिना कंकाल का मानव शरीर है। फिर एक हैंगर को झोले मे रख कर दिखाइए कि अब इसका एक आकार है। यह अनुमान लगाने मे उनकी मदद कीजिए कि बिना कंकाल के हमारा शरीर खाली झोले के समान है लेकिन कंकाल के साथ यह एक निश्चित आकार का हो जाता है। अन्य उदाहरण दीजिए जैसे बिना खम्बे का तम्बू, बिना ढांचे की झोपड़ी जिनमें ढ़ाचे के अभाव में आकार नहीं होगा।

खाली झोला, हैंगर

झोला और सहारा देने वाले ढांचे के साथ झोंपड़ी

क्रियाकलाप 4

जानकारी करना कि अस्थियाँ हमारे शरीर के कोमल अगो की रक्षा करती हैं

छात्रो से निम्न प्रश्न पूछिए:
रेडियो/टेलीविजन में एक वाह्य पेटिका क्यो होती है?
यदि रेडियो/टेलीविजन के बाहर पेटिका न हो तो क्या होगा?
यदि तुम्हारा पेन ढक्कन के साथ गिरता है तो निब का क्या होगा? (निब टूटने से बच जायेगी)
यदि तुम्हारा पेन बिना ढक्कन के गिरता है तब क्या होगा? (निब टूट जाएगी)

अन्य उदाहरण भी दीजिए जैसे गावो मे खेतों मे अनाज, भूसे के ढ़ेर मे हवा तथा पानी से सुरक्षित रहता है।

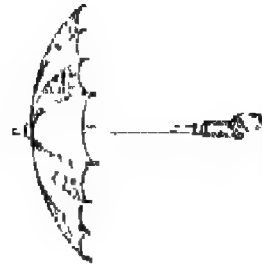
निम्न तथ्यों की तुलना द्वारा छात्रों से अभिव्यक्त कराइए।
हमारी अस्थियां हमारे शरीर के कोमल अंगो की रक्षा करती हैं जैसे मस्तिष्क कवच (क्रेनियम) मस्तिष्क की सुरक्षा, वक्षीय ढाचा हमारे फेंफड़ो तथा हृदय की सुरक्षा, रीढ़ हमारे रीढ रज्जु की सुरक्षा करता है।

छात्रों द्वारा अस्थियों के दूसरे प्रमुख कार्य का अनुमान लगाने के लिए निम्न प्रश्न पूछिए:
यदि तुम्हारे शरीर में अस्थियां न हो तो क्या स्थिति होगी?

क्रियाकलाप 5

अस्थियो के विभिन्न जोडो तथा उनके द्वारा ही गति सभव है, इसे पहचानना

छतरी

छात्रों के सामने एक छतरी खोलिए और पूछिए:
तुम छतरी के भीतर की ओर क्या देखते हो? (तीलियां)
छतरी में तीलियों का क्या प्रयोग है?
छतरी को एक निश्चित आकार किस वस्तु ने दिया है?
मानव शरीर तथा छतरी की तुलना करने मे छात्रों की सहायता कीजिए।
वे अनुमान लगाएं कि तीलिया, छतरी को आकार देती है, जिस प्रकार हड्डियां शरीर को एक निश्चित आकार प्रदान करती है।
छतरी की प्रत्येक तीली आपस में कैसे जुड़ी हुई है?
वे क्यों जुड़ी हुई है?
क्या तुम देखते हो कि ये भी हमारी अस्थियो से मिलती जुलती है क्योंकि वे भी जोडयुक्त हैं?
यह अनुमान करने में छात्रो की सहायता कीजिए कि जोड़ों की सहायता से हमारे शरीर के भागो में लोचदार गति सभव है।

तीली-युक्त छतरी

छात्रों से कहिए कि वे अपने हाथों से अपने कंधे छुए।

पूछिए:
अगली बांह कहा से मुड़ती है?
क्यों?
कल्पना कीजिए कि तुम्हारी बांह में जोड नही है, तब क्या तुम अपने कंधे छू सकोगे?
(नहीं)

क्रियाकलाप 6

एक बड़ी तथा छोटी सूखी पतली टहनी के दो टुकडो अथवा माचिस की दो तीलिया लेकर एक रबड़ ट्यूब/सेलोटेप से चित्र के अनुसार आपस में जोड दीजिए। बिना जोड़ वाले एक बड़े टुकडे को बीच से मोड़िए। (यह नहीं मुड़ेगा बल्कि दो टुकडों में टूट जाता है)।

दो माचिस की तीली/दो सूखी टहनी, रबर ट्यूब/सेलोटेप

माचिस की तीलियों का जोड़ से मुड़ना

अब दो टुकड़ो की जोड़ वाली जगह से मोड़िए। (यह आसानी से मुड़ जाता है क्योंकि दोनों टहनियों के मध्य जोड़ है)।

अपनी बांहों को ऊपर और नीचे कुछ बार ले जाइए और देखिए कि जोड़ों के कारण ही गति संभव है।
छात्रों से कहिए कि कोहनी पर से बांह, हाथ, मोड़े तथा इसे कधे की ओर ले जाएं।
टहनियों के जोड़ पर उन्हें मोडने के क्रियाकलापों की तुलना मानव.हड्डियों को जोड़ों के मोडने से करके छात्रो द्वारा यह निष्कर्ष निकलवाइए कि मानव शरीर मे हड्डियों के जोड अधिक युक्तिचालन कुशल गति में सहायक होते हैं।

क्रियाकलाप 7

छात्रो से कहिए कि अपनी बांहें झुकाएं और फैलाएं।
उनसे कहिए कि दरवाजें खोलें तथा बद करें।
दोनों गतियों में क्या समानता है?
एक दिशा में होने वाली इन दोनों गतियों की तुलना करने मे छात्रों की सहायता कीजिए। उनसे कहिए कि इस गति की तुलना कधे से बाहें घुमाने वाली गति से करें।
छात्रों से कहिए कि इसी प्रकार के जोड़ों को घुटनों तथा कूल्हो आदि में पता लगाएं। छात्रो से कहिए कि इसी प्रकार के कुछ अन्य उदाहरण दें।

क्रियाकलाप 8

पेशियो के प्रमुख कार्यों को जानना।

मानव शरीर में होने वाली ऐच्छिक और अनैच्छिक गतियों को अनुभव द्वारा विभेदन कीजिए।
छात्रों से कहिए कि अपनी बाहो को कुहनी से मोड कर ऊपरी बांहें की पेशियों को अनुभव करे।
बांहें सीधे होने पर पेशियां किस अवस्था में थी?
बांह मोड़ने पर पेशियां क्यों उभर आती हैं?
इंगित कीजिए कि बांहों की गति पेशियों के संकुचन तथा शिथिलन के कारण होती है।

क्रियाकलाप 9

ऐच्छिक तथा अनैच्छिक पेशियों को पहचानना

छात्रों से कहिए कि वे अपनी आखें बन्द करें और खोले, हंसें, अपने हाथों को ऊपर, नीचे, तथा बगल में ले जायें और फिर उनकी गति बन्द कर दें।

पूछिए:
क्या ये गतिया आप के नियत्रण में है?
यह समझने में छात्रों की सहायता कीजिए कि कुछ गतियां जैसे हृद पेशियों, आमाशय, तथा आत आदि उनके नियंत्रण में नहीं है (अनैच्छिक) जब कि अन्य पेशिया उनके नियंत्रण में हैं (ऐच्छिक)। (शब्दावली से परिचित करवाइए—ऐच्छिक तथा अनैच्छिक) छात्रो से एक सूची बनवाइए जिसमें शरीर में होने वाली ऐच्छिक गतियां तथा अनैच्छिक गतियां अंकित हों (जैसे आंखों का झपकना) आदि, नीचे की सारणी में अंकित करें।

गतियों की सूची	ऐच्छिक	अनैच्छिक

क्रियाकलाप 10

पेशियों के समुचित विकास करने वाले कारकों को पहचानना

छात्रों को मैदान में ले जाइए और एक छात्र से कहिए कि वह पहले दाहिने हाथ से एक पत्थर पूरी ताकत से फेंके और फिर बाएं हाथ से भी एक पत्थर फेंके। जहां पत्थर गिरते हैं वहां चिन्ह लगा दे।

पत्थर

पूछिए:
एक हाथ द्वारा फेंके हुए पत्थर की दूरी दूसरे हाथ द्वारा फेंके हुए पत्थर की तुलना में अधिक क्यों है? इंगित कीजिए कि जिस हाथ से अधिक दूरी तक पत्थर फेंका गया वह हाथ निरन्तर प्रयोग किया जाता रहा है और वह मजबूत तथा अधिक विकसित होता है। दूसरे हाथ की पेशियां जिसका उपयोग यदाकदा ही होता है, कम मजबूत तथा कम विकसित होता है। खिलाड़ी, व्यायामी तथा पहलवान व्यायाम द्वारा अपने शरीर की पेशियों को शक्तिशाली बना लेते हैं।

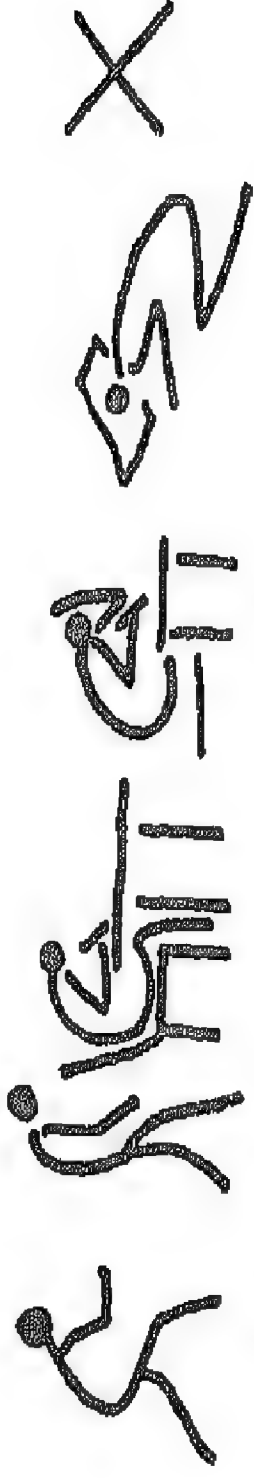
निष्कर्ष निकालिये कि व्यायाम करने से हमारे शरीर की पेशिया मजबूत हो जाती हैं इसीलिए तैराकों और धावकों की पेशियां हमारी पेशियों की अपेक्षा अधिक मजबूत होती हैं। खिलाड़ी अपनी पेशियों को शक्तिशाली बनाने के लिए अभ्यास करने में अधिक समय देते हैं।

क्रियाकलाप 11

सही तथा गलत मुद्रा स्थिति (दोनों-बैठने तथा खड़े होने की) को दर्शाने वाले चित्र छात्रों को दिखाइए तथा उनसे कहिए कि सही और गलत मुद्राओं की स्थिति में अतर बताएं।

बैठने तथा खड़े होने की सही तथा गलत मुद्रा के चित्र

अब चित्र दिखाकर उन्हें सही मुद्रा स्थिति के बारे में समझाइए।

पूछिए-
पढ़ते समय आंख से वस्तु की सही दूरी क्या है? (30 से.मी.)
क्या होता है जब मुद्रा स्थिति गलत होती है? (कूबड़पन, पेट निकलना तथा नेत्र विकार)
छात्रो से कहिए कि बैठने, खड़े होने तथा पढ़ने की सही मुद्रा का अभ्यास करें।
उन्हें प्रोत्साहित कीजिए कि नियमित व्यायाम द्वारा अपनी पेशियों को विकसित करें तथा स्वस्थ रहें।

विस्तारण 1

छात्रों से कहिए कि सुविकसित पेशियो वाले खिलाड़ियो, पहलवानों, भारोत्तोलको आदि के चित्रो के संग्रह करें।

2.2: भोजन के अन्तर्ग्रहण का मनुष्य की आयु तथा व्यवसाय से क्या सम्बन्ध है?

केंन्द्रित करें: आयु तथा व्यवसाय का भोजन अन्तर्ग्रहण से सम्बन्ध

(कालाश 2-3)

अधिगम परिणाम	प्रस्तावित शिक्षण प्रक्रम	साधन एवं सामग्री
भोजन के अन्तर्ग्रहण का मनुष्य की आयु तथा पेशे से सम्बन्ध स्थापित करना	क्रियाकलाप 1 छात्रों से कहिए कि यह निरीक्षण करे कि शिशु, विभिन्न आयु के बच्चे, युवा, प्रौढ़ तथा वृद्ध कितना भोजन ग्रहण करते है। वे उनके भोजनो के बीच के समय का अन्तर भी देखे। यह निष्कर्ष निकालने मे छात्रों की सहायता कीजिए कि शिशु कम समयान्तराल मे तथा कम भोजन करता है। भोजन की मात्रा तथा समयान्तराल, आयु के अनुसार बढता जाता है। एक नौजवान के लिए समयान्तराल सर्वाधिक होता है। वृद्धावस्था मे भोजन ग्रहण की मात्रा घट जाती है। निम्न प्रश्नों द्वारा छात्रों को पूर्व ज्ञान का स्मरण कराइए। शरीर का निर्माण करने वाले पोषक तत्वो से परिपूर्ण दूध/भोजन बच्चो को क्यों दिया जाता है? वृद्ध व्यक्तियों को कम ऊर्जा प्रदान करने वाले भोजन लेने का परामर्श क्यो दिया जाता है? समझाइए कि बच्चों को उचित शारीरिक वृद्धि के लिए शरीर निर्माण करने वाले भोजन की आश्यकता होती है। छात्रो का ध्यान उनके दैनिक जीवन के निरीक्षण की ओर आकृष्ट कीजिए। पूछिए सामान्यत: कौन-सा व्यक्ति अधिक भोजन करेगा, एक मजदूर, अथवा एक व्यक्ति जो कार्यालय मे बैठ कर कार्य करता है? (एक श्रमिक, क्योंकि वह अधिक ऊर्जा खर्च करता है, उस व्यक्ति की अपेक्षा जो बैठ कर कार्य करता है) उनका ध्यान इस तथ्य की ओर आकृष्ट कीजिए कि भोजन अन्तर्ग्रहण की मात्रा मनुष्य के व्यवसाय के अनुसार बदलता है। शारीरिक श्रम करने वाले व्यक्ति को अधिक भोजन की मात्रा तथा मानसिक	

कार्य करने वाले व्यक्ति को कम भोजन की आवश्यकता होती है।
निम्न प्रश्नों द्वारा छात्रों को फिर पूर्व ज्ञान का स्मरण कराइए:
हमें भोजन की आवश्यकता क्यों होती है?
(ऊर्जा प्राप्ति, ऊतकों एवं अंगों की मरम्मत तथा बीमारियों से शारीरिक सुरक्षा के लिए)
वे भोज्य पदार्थ जो वृद्धि के लिये आवश्यक हैं, किसे अधिक चाहिए?
(बच्चों को)
तुम्हारी माता जी तुम्हें प्रतिदिन दो-तीन बार दूध पीने को क्यों कहती है?
(दूध में शरीर निर्माण वाले पोषक तत्व प्रचुर मात्रा मे है जो बच्चों के लिए अति आवश्यक हैं)
शरीर निर्माण करने वाले पोषक तत्वो से युक्त और कौन-कौन भोज्य पदार्थ है?
(दूध, दूध द्वारा निर्मित पनीर व दही, मूंगफली, अंडा, मछली, मांस)

विस्तारण 1

छात्रों से कहिए कि-
वे उन भोज्य पदार्थों, जो शरीर निर्माण वाले पोषक तत्वों से भरपूर हैं, के चार्ट बनाएं तथा चित्रों का संग्रह करें।
विभिन्न प्रकार की दालो को एकत्र करके उन्हें छोटे-छोटे प्लास्टिक थैलों में रखकर चार्ट पर चिपकाएं।

2.3: अभाव जनित बीमारियों क्या हैं?
केंद्रित करें: अभावजनित बीमारियों के कारण और निवारण

(कालांश 3-4)

अधिगम परिणाम	प्रस्तावित शिक्षण प्रक्रम	साधन एव सामग्री
	क्रियाकलाप 1	
समुचित मात्रा में भोजन लेने की आवश्यकता एव सभी समूहो की उचित मात्रा की उपस्थिति से अवगत कराना	निम्न प्रश्नों की सहायता से छात्रों के पूर्व ज्ञान का परीक्षण कीजिए। तुम्हारा प्रिय भोजन क्या है? हमे भोजन की आवश्यकता क्यों होती है? भोज्य पदार्थो के तीन प्रकार क्या हैं?	

((क) ऊर्जा प्रदान करने वाले (ख) शरीर का निर्माण करने वाले (ग) संरक्षात्मक भोजन)
तुमने कलेवा में क्या लिया?
क्या यह ऊर्जा प्रदान करने वाला, शरीर निर्माण करने वाला या सरक्षात्मक भोजन था?
यदि तुम्हें अपर्याप्त भोजन मिले तो क्या होगा?
(हमें कमजोरी का अनुभव होगा, और न काम कर पायेंगे और न ही खेल पायेंगे)

उनसे पूछिए:
तुम अपने प्रतिदिन के भोजन में क्या खाते हो?

क्रियाकलाप 2

छात्रो द्वारा प्रति दिन लिए जाने वाले भोजन का एक चार्ट बनाइए और देखिए कि क्या वे विभिन्न वर्गो के भोज्य पदार्थ की प्रर्याप्त मात्रा ले रहे हैं।

सन्तुलित भोजन का चार्ट

भोजन वर्ग	कलेवा	दिन का भोजन	रात्रि भोजन
ऊर्जा प्रदान करने वाले खाद्य पदार्थ (जैसे अनाज, शार्करा तेल, चिकनाई आदि)			
शारीरिक निर्माण वाले खाद्य पदार्थ (अण्डा, दूध आदि)			
संरक्षात्मक खाद्य पदार्थ (हरी पत्तीदार सब्जियां, फल आदि)			

उनके भोजन का विश्लेषण कीजिए और "संतुलित आहार सारणी", से तुलना करके देखिए कि वह पर्याप्त भोजन जिसमे भोजन के तीनों वर्ग सम्मिलित हैं, ले रहे हैं अथवा नही।

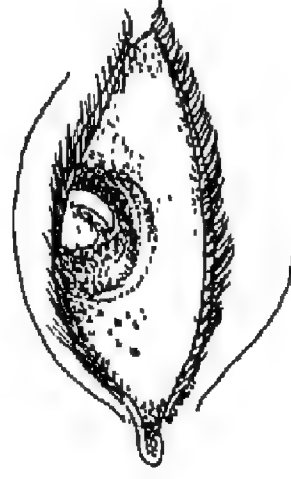
अभाव जनित रोगों के कारणों की पहचान करना

पूछिए:
यदि तुम केवल मिष्ठान ही खाते रहे तो क्या परिणाम होगा?
क्या होगा यदि तुम केवल दालें ही खाओगे?
क्या होगा यदि तुम फल और सब्जियां नही खाओगे?
विटामिन चार्ट बनाइए और दिखाइए।
उनको यह समझने में मदद कीजिए कि फल और सब्जियों में विटामिन होते हैं।

आहार का चार्ट (विभिन्न भोज्य पदार्थ, उनमे पाये जाने वाले विटामिन और उनके अभाव जनित रोगो का चार्ट)

यदि प्रतिदिन के आहार में विटामिन "ए" और विटामिन "बी" नहीं है तो कौन-सी बीमारियां उत्पन्न होंगी?
इंगित कीजिए कि ऊर्जा प्रदान करने वाले, शरीर निर्माण करने वाले तथा संरक्षात्मक तीनो वर्गों के भोजन लेने आवश्यक हैं। केवल एक ही प्रकार का भोजन करने से अभावजनित रोग उत्पन्न होते हैं।

सामान्य अभावजनित रोगों को पहचानना

छात्रो से कुछ ऐसे रोगों के नाम पूछिए जिन्हें वे जानते हैं।
निम्न सारणी की सहायता से उन्हें समझाइए कि ये सामान्य अभावजनित रोग हैं, जो किसी प्रकार की कमी से उत्पन्न होते हैं।

विटामिन ए और बी के अभाव से होने वाली बीमारियां

अभावजनित रोगों के कारण और उपचार

कारण	रोगो का नाम	रोग लक्षण	कमी के कारण	निदान के उपाय
सुरक्षात्मक भोजन की कमी	घेंघा	गल ग्रंथी में सूजन	आयोडीन	आयोडीनयुक्त लवण
	स्कर्वी	मसूडो से रक्त स्राव	विटामिन "सी"	नीबू, सन्तरा एवं अन्य साइट्रिक फल
	बेरी-बेरी	शरीर पर चित्ते, पैरों मे सूजन	विटामिन "बी" काम्पलेक्स	हरी सब्जियां और फल
	रिकेट्स	धनुष की भांति मुडी टांगे	कैल्सियम	दूध, सूर्य स्नान
	रक्तालपता	शरीर की त्वचा का पीली होना	लोहा	हरी पत्तेदार सब्जियां, फल
	रतौंधी	कम प्रकाश मे न देख पाना	विटामिन ए	गाजर, आम, पपीता पका हुआ
शरीर निर्माण करने वाले भोजन की कमी	क्वाश्योरकर	वृद्धि मंदित, त्वचा तथा बाल शुष्क एव रूखे	प्रोटीन	अंडा, मास, मछली, दूध दालें
ऊर्जा देने वाले भोजन की कमी	मेरास्मस	मांस तथा शक्ति का धीरे-धीरे लोप/क्षय	शर्करा, वसा अनाज	शक्कर, तेल, घी

चोट लगने या दुर्घटना होने पर जब अधिक रक्तस्राव हो जाता है तो तुम कैसा अनुभव करते हो? (दुर्बलता)

क्रियाकलाप 3

रक्तक्षीणता तथा नेत्र दोष के कारणों को पहचानना

रक्त की कमी से रक्तक्षीणता का रोग उत्पन्न होता है। यह लोहयुक्त भोजन की अपर्याप्त मात्रा के कारण होती है।

हरी पत्तीदार सब्जियों तथा फलों के महत्व पर प्रकाश डालिए। इन में लौह तत्व पाया जाता है, जो रक्त निर्माण के लिए आवश्यक है तथा इनमे विभिन्न बीमारियों से संरक्षण करने वाले पोषक तत्व भी पाए जाते हैं।

पूछिए:
क्या तुम रात्रि में मंद प्रकाश में देख सकते हो?
क्या तुम हरी सब्जियां खाते हो?

छात्रो को समझाइए कि मंद प्रकाश में न देख पाना एक रोग का लक्षण है, जिसे रतौंधी कहते हैं। पत्तीदार हरी सब्जियों तथा लाल पीले गूदें वाली सब्जियों और फलों जैसे गाजर, आम, पपीता, टमाटर कद्दू आदि भोजन में सम्मिलित न होने के कारण यह रोग होता है। उन्हें यह भी बताइए कि यही कारण रक्तक्षीणता भी उत्पन्न कर सकता है।

विस्तारण 1

छात्रों से कहिए कि वे प्राकृतिक रंगों वाले फलों और सब्जियों के चित्रों का संग्रह करके स्क्रेप (कतरन) नोटबुक पर चिपकाएं।

2.4: भोजन की सामान्य आदतें तथा धारणाएं क्या हैं?

केंन्द्रित करें: समाज (समुदाय) में भोजन सम्बन्धी सामान्य आदतें और धारणाएं

(कलाश 3-4)

अधिगम परिणाम	प्रस्तावित शिक्षण प्रक्रम	साधन एवं सामग्री
	क्रियाकलाप 1	
विभिन्न समाजो मे भोजन की सामान्य आदतो को पहचानना	छात्रों से कहिये कि वे अपना भोजनवाहक (टिफन कैरियर) खोलें और बतायें कि वे उस दिन के भोजन में क्या लाये हैं? (चावल, पूड़ी, चपाती, डोसा, इडली, मिठाई, फल) प्रदेशानुसार आहार के वर्गीकरण करने मे छात्रो की सहायता कीजिए। निम्न सारणी की आपूर्ति करवाइए।	

आहार	समाज
इडली	दक्षिण भारतीय
— — —	— — —
— — —	— — —
— — —	— — —

यह निष्कर्ष निकालने में छात्रों की सहायता कीजिए कि भोजन सम्बन्धी आदतें अलग अलग समाजो मे भिन्न होती हैं।

क्रियाकलाप 2

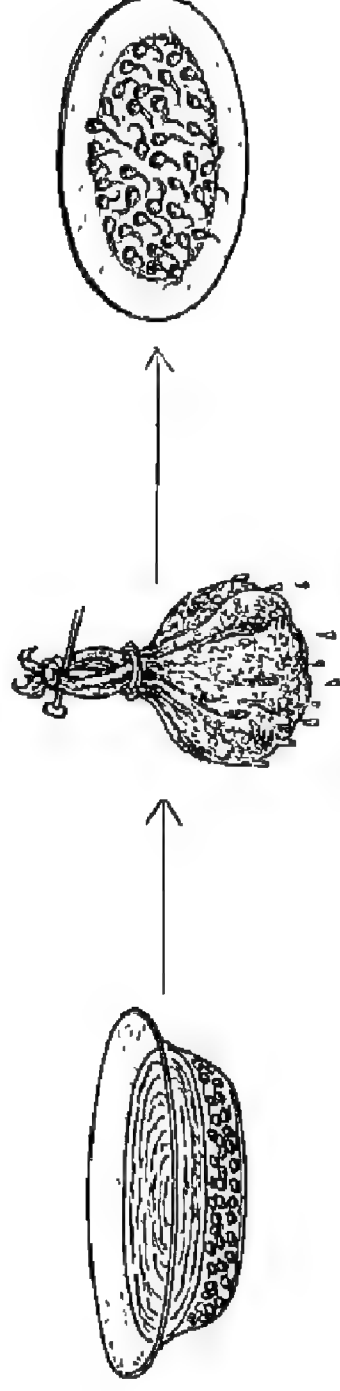
भोजन की उन आदतो को पहचानना जो अच्छे स्वास्थ्य के लिये आवश्यक है

पूछिये:
तुम्हारी माँ तुम्हें खाने को क्या देती है जब तुम्हे पतले दस्त होते है? (खिचड़ी)
हम खिचड़ी कैसे पकाते हैं? (उबालकर)
खिचड़ी खाने के बाद तुम कैसा अनुभव करते हो? (आराम)
छात्रों को यह परिणाम निकालने मे सहायता कीजिए कि उबला भोजन आसानी से पचता है। यह भी बताइये कि उबले भोजन में विटामिन अधिक होते हैं और पोषक पदार्थ सुरक्षित रहते हैं, जो आसानी से पचते हैं।

क्रियाकलाप 3

चना, सूती कपडा, पेय जल, बर्तन

छात्रों से कहिए कि वे एक छोटी कटोरी लेकर उसमें एक मुट्ठी चना 8-10 घंटे तक पानी में भिगों दे। अब इन चनों को एक सूती कपड़े के टुकड़े में रख कर ढीले से बांध दें। अब इसे अंकुरित होने तक रखें।

छात्रो को प्रोत्साहित कीजिए कि उपर्युक्त प्रयोग को गेहूं, मक्का, बाजरा और ज्वार तथा उरद,मूंग, आदि दाल लेकर घर पर करे।
समझाइए कि अंकुरित चने का पोषक मूल्य अधिक है और इसे लगातार प्रयोग करें।

बीजों का अंकुरण

विस्तारण 1

छात्रों से कहिए कि एक प्याला चावल तथा एक चौथाई प्याला उरद पानी में रात भर भिगोएं। सुबह दोनों को अलग-अलग पीसें। अब इसे पांच घंटों तक किण्वन के लिये छोड़ दें। अब इसे छोटी-छोटी कटोरियों में रखकर भाप में पकाएं। भाप में पकाने के बाद इसे खाएं। इस किण्वित भोजन में विटामिन अधिक होता है।

चावल, उरद, पीसने के लिए सिल, पात्र, कटोरी, ढक्कन

विस्तारण 2

छात्रों से कहिए कि गाजर, सेम, गोभी आदि सब्जियों को काट कर उबालें। नमक, काली मिर्च, डाल कर नीबू का रस निचोड़े और खाएं।
छात्रों को इस बात का बोध कराएं कि उबली सब्जियों में अधिकतम मात्रा में विटामिन तथा खनिज लवण होते हैं।

गाजर, सेम, फूलगोभी, नमक, काली मिर्च, नीबू

विस्तारण 3

अंकुरित चने, नीबू का रस, नमक तथा काली मिर्च मिलाकर चाट बना सकते हैं। छात्रों को बताइए कि उबला तथा अंकुरित भोजन भी खाने में स्वादिष्ट होता है।

अंकुरित चने, नीबू, नमक, काली मिर्च

क्रियाकलाप 4

अपने क्षेत्र में भोजन की दोषयुक्त आदतों को पहचानना

परिचर्चा कीजिए:

1. एक बार पकाए भोजन को दिन में तीन बार (कलेवा, दिन का भोजन, रात्रि भोजन) खाने की आदत सुविधाजनक/अच्छी/खराब है।
2. भोजन जैसे अनाज, आलू, मक्का, आदि को विभिन्न रूपों में प्रत्येक समय नहीं लेना चाहिए।

(असंतुलित आहार)

3. अत्यधिक पौष्टिक आहार का सेवन, जिसमें सब्जियों तथा फलों मे उपस्थित रुक्षांश न हो, भी हानिप्रद होता है।

2.5: भोजन के परिरक्षण की क्या आवश्यकता हैं? केंन्द्रित करें: भोजन परिरक्षण की विभिन्न विधियां

(कालाश 3-4)

अधिगम परिणाम	प्रस्तावित शिक्षण प्रक्रम	साधन एवं सामग्री
	क्रियाकलाप 1	
भोजन के परिरक्षण तथा भण्डारण की आवश्यकता को पहचानना	छात्रों का ध्यान उनके प्रतिदिन के निरीक्षणों की ओर आकृष्ट कीजिए। पूछिए: ग्रीष्म ऋतु में उपलब्ध सब्जियों/दालों के नाम बताइए? शीत ऋतु में अधिक मात्रा मे उपलब्ध कुछ सब्जियों/फलों के नाम क्या हैं? छात्रों को बताइए कि फल और सब्जियाँ मौसमी होती है और जल्दी खराब हो जाती है। परिरक्षण करके उन्हे अन्य मौसमो में भी प्रयोग कर सकते हैं।	
	क्रियाकलाप 2	
	छात्रों से कहिएं कि वे कोई भी मौसमी फल और सब्जी लेकर एक सप्ताह के लिए अलग छोड़ दे। एक रोटी का नम टुकड़ा, आलू या पालक लीजिए और उसे कक्ष के अंधकारमय कोने मे रख दीजिए। 3-4 दिन बाद छात्रों से कहिए कि उस पर उत्पन्न उन काले धब्बों को आवर्धक लैंस द्वारा देखें जो भोजन के खराब होने की स्थिति बताते हैं। यह परिणाम निकालने में छात्रों की सहायता कीजिए कि भोज्य पदार्थ खराब हो जाते हैं अतः इनका परिरक्षण उचित रूप से होना चाहिए।	मटर, आम, नीबू, रोटी, पालक, आलू, हैण्ड (आवर्धक) लेन्स
	क्रियाकलाप 3	
अनाज के उचित रख-रखाव की विधियों को जानना	अनाजों के उचित रख-रखाव की विधियों की चर्चा कर, उनसे पूछिए:	

तुम्हारी माँ दालों और अनाज को घर में किस प्रकार संग्रह करके रखती हैं?
(पात्रों में, जो वायुरोधक होते हैं)
अनाज संग्रह करने के पूर्व वे पात्रों में क्या डालती हैं?

फलो और सब्जियों को तुम्हारी माँ कैसे परिरक्षित करती है?
कुछ अन्य भोज्य पदार्थों के नाम बताइए जो परिरक्षित किये जाते हैं और उस मौसम में खाये जाते हैं जिसमें वे नहीं मिलते हैं?
(अचार के रूप में)

क्रियाकलाप 4

भोजन के परिरक्षण की विभिन्न विधियों पर छात्रो से चर्चा कीजिए।

निर्जलीकरण:

भोजन के परिरक्षण की विभिन्न विधियों को जानना

छात्रों को निर्जलीकृत (धूप में सुखाए) फल, सब्जियों के कुछ नमूने जैसे फूल गोभी, धनियां तथा पोदीने की पत्तियां दिखाइए।
सूखने के बाद भोजन पदार्थ खराब क्यो नहीं होते हैं?
नमी की अनुपस्थिति में सूक्ष्म जीव जिन्हें हम अपनी आंखो से देख नहीं सकते, वृद्धि नहीं कर पाते, जिससे भोजन पदार्थ खराब नही होते हैं।

सुखाई गई सब्जियाँ जैसे फूल गोभी, शलजम, पोदीना और धनिया की पत्तिया

क्रियाकलाप 5

उबालना:

दो बर्तनों में बराबर दूध लीजिए। एक बर्तन का दूध उबाल दीजिए और दूसरे का वैसा ही रहने दीजिए। दिन बीतने पर निरीक्षण कीजिए और पता कीजिए कि किस बर्तन का दूध खट्टा हो गया है। छात्रों को समझाइए कि उबालने से कुछ समय के लिए भोजन का परिरक्षण हो जाता है।

दो बर्तन, दूध

क्रियाकलाप 6

परिरक्षक:

नमक मिलाकर:

छात्रों से कहिए कि एक नीबू के चार टुकड़े करके नमक मिला कर एक जार में रखें और धूप में 4-5 दिन तक छोड़ दे।

दो नीबू, नमक, जार

इसी प्रकार एक नीबू बिना नमक मिलाए जार में रख दे। ये नीबू खराब हो जाता है तथा दूसरे जार में नीबू का अचार तैयार हो जाता है।

छात्रों को स्पष्ट कीजिए कि नमक मिलाने से नीबू का परिरक्षण हो जाता है।

क्रियाकलाप 7

शर्करा के घोल में रखकर:

पूछिए:
जैम/मुरबा क्या हैं?
जैम/मुरब्बे का स्वाद मीठा क्यों है?
फल अधिक समय तक जैम/मुरब्बे के रूप मे सुरक्षित क्यों रहते है?
छात्रों को यह समझने में मदद कीजिए कि नमक, शर्करा, सिरका, प्राकृतिक परिरक्षक पदार्थ हैं। कुछ कृत्रिम परिरक्षक पदार्थ भी हैं जैसे ग्लेसियल ऐसिटक एसिड और सोडियम बेनजोएट आदि जो जैमो तथा चटनी आदि में परिरक्षक की भांति प्रयोग किये जाते हैं।

क्रियाकलाप 8

यह जानना कि कम ताप भोजन के गुणो को बनाए रखता है और भोज्य पदार्थों का परिरक्षण करता है।

छात्रो को बोध कराइए कि जीवाणु, शर्करा/नमक के सांद्र घोल में वृद्धि नही करते। इसी प्रकार कम/न्यून ताप भी भोजन का परिरक्षण करता है
किस मौसम में भोजन जल्दी सड़ जाता है?
जाड़ो में भोजन इतनी जल्दी खराब क्यो नहीं होता है?
जाड़ो में दूध इतनी जल्दी खट्टा क्यों नहीं होता है?

यह निष्कर्ष निकालने में छात्रों की सहायता कीजिए कि कम ताप भोजन को नष्ट होने से रोकता है। रैफरीजरेटर/तात्कालिक फ्रिज में तापक्रम कम होता है, इसीलिए उसमें भोजन ताजा बना रहता है और जल्दी खराब नहीं होता है।

विस्तारण 1
तात्कालिक/स्वनिर्मित फ्रिज

	मिट्टी का एक घड़ा लीजिए। उसके चौथाई भाग में नम बालू भर कर कपड़े से ढ़क दीजिए। अब यदि इसमें भोजन रखा जाय तो जल्दी खराब नहीं होगा।	मिट्टी का घडा, वालू, कपडा, पानी

विस्तारण 2

	छात्रों से कहिए कि वे मौसमी सब्जियाँ जैसे शलजम, फूल गोभी, मिर्च आदि धूप मे सुखा कर (निर्जलीकरण कर के) रखें। छात्रों से जैम/जैली स्कूल में बनवाइए। गाजर, आंवला, सेव को वे शक्कर के सांद्र घोल में रखें। इसको "सीखने के साथ कमाओ" परियोजना के रूप मे आगे बढ़ाया जा सकता है।	मौसमी सब्जियाँ, फल, शकंरा, शीशिया/डिब्बे

2.6: संक्रामक रोगों को फैलाने वाले कारक क्या है और इनकी रोकयाम के लिए क्या उपाय करने चाहिए?
केन्द्रित करें: सक्रांमक रोगों के कारण और उनकी रोकथाम

(कालाश 2)

अधिगम परिणाम	प्रस्तावित शिक्षण प्रक्रम	साधन एवं सामग्री
	क्रियाकलाप 1	
सक्रामक रोगों के फैलने में सहायक कारकों को पहचानना।	पूछिए: सक्रामक रोग क्या हैं? यह समझने में छात्रों की मदद कीजिए कि कुछ रोग एक मनुष्य से दूसरे मनुष्य को संचारित हो जाते हैं। इनको संक्रामक रोग कहते हैं। दिन-प्रतिदिन के अनुभवों की ओर छात्रों का ध्यान आकृष्ट कीजिए। पूछिए: स्नानघर में तुम किन-किन वस्तुओं का उपयोग करते हो? क्या तुम उन्हीं वस्तुओ का उपयोग रसोई घर में करते हो? क्यों?	

(अस्वास्थ्यकर, विभिन्न रोगो के रोगाणुओं का वहन)
तुम्हे दूसरे व्यक्ति द्वारा प्रयोग किये गए गिलास मे पानी पीने को क्यों रोका जाता है?
(दूसरा व्यक्ति किसी रोग से ग्रसित अथवा रोगाणुओं का वाहक हो सकता है)
तुम्हे ऐसे व्यक्ति के पास जाने की अनुमति क्यों नहीं दी जाती है जो चेचक, अथवा खसरे से ग्रसित हो?
(तुम्हें वही रोग लग सकता है)

इलाके मे होने वाले सामान्य रोगो को पहचानना

छात्रों को बोध कराइए कि सदूषित/सक्रमित भोजन, पानी, हवा, कपड़े या संक्रमण व्यक्ति का सम्पर्क, संक्रमण/संदूषण कर सकता है।
छात्रों से कुछ ऐसे सामान्य रोगों के नाम पूछिए जो उनके क्षेत्र मे होते हों।
(सर्दी, जुकाम, छोटी चेचक, खसरा, गलसुआ, अतिसार, उल्टी और बुखार, आदि)
उन रोगों के बारे में बताइए जो एक व्यक्ति से दूसरे व्यक्ति मे पहुंचते हैं।
(नेत्र फलू (कान्जक्टीवाइटिस), छोटी माता, खसरा, चेचक, अतिसार, गलसुआ)
पूछिए:

संक्रामक रोगों को फैलने से रोकने के उपायो को पहचानना

मलेरिया कैसे फैलता है?
(यह मादा मच्छरो के काटने से फैलता है)

छींकते तथा खांसते समय तुमसे मुंह ढकने के लिए क्यो कहा जाता है?
(तुम रोगाणु प्रसारित कर सकते हो)
क्या रोगाणु वायुमंडल में होते है?
(हां, ये वायुमडल में होते है)
यदि पागल कुत्ता काट ले तो क्या होगा?
(इससे रेबीज हो जाएगा)
ये रोग कैसे फैलते हैं?
(संक्रामक रोग वायु, पानी, भोजन, प्रत्यक्ष अथवा अप्रत्यक्ष रूप से सम्पर्क और कीटों तथा अन्य जानवरों के काटने से फैलते हैं)
पूछिए:

सक्रामक रोगो के फैलने के तरीकों को पहचानना

खसरा रोग से ग्रसित बच्चे को अलग क्यों रखा जाता है?
भोजन करने के पूर्व या गन्दी वस्तु के छू जाने पर हाथ धाने को क्यों कहा जाता है?
(रोगाणुओं को फैलने से रोकने के लिए)
जब किसी महामारी (जब एक इलाके में बहुत से लोग एक ही रोग से ग्रसित्त हो जाते हों) की सम्भावना

होती है तब लोगो को पानी उबाल कर पीने की सलाह क्यों दी जाती है? (रोग को फैलने से रोकने के लिए)

इन संक्रामक रोगों की रोकथाम किस प्रकार की जा सकती है?

(पूर्व सावधानी से संक्रामक रोगों को फैलने से रोकने मे सहायता मिलती है)

तुम्हें बाजार मे खुला भोजन तथा गलियों में खोमचे वालों से लेकर खाने को क्यों मना किया जाता है?

(हवा में उपस्थित रोगाणुओं से भोजन का संदूषण होता है। खुले भोजन पर मक्खियों के बैठने से विभिन्न प्रकार के रोगाणुओं का प्रसारण हो जाता है और भोजन संदूषित हो जाता है)

यदि तुम गन्दा पानी पियोगे तो क्या होगा?

(सदूषित पानी, पीलिया, हैज़ा, पेचिश आदि रोग उत्पन्न कर देता है)

यह निष्कर्ष निकालने में छात्रों की सहायता कीजिए कि पानी, हवा, भोजन और कपड़ों के संदूषण से बचाव द्वारा संक्रामक रोगों का प्रसार रोका जा सकता है।

क्रियाकलाप 2

उन उपायों को पहचानना जिनसे समुदाय मे संक्रामक रोगो की रोकथाम की जा सकती है

पूछिए:

तुम अपनी नाक पर हाथ, रूमाल क्यों रखते हो जब तुम सार्वजनिक मूत्रालय/शौचालय से होकर गुजरते हो?

(दुर्गन्ध के कारण)

तुमने अपने आसपास खुले नाले और गन्दे तालाब के समीप क्या देखा है?

(मच्छर, मक्खियां, आदि)

छात्रों को निष्कर्ष निकालने में सहायता कीजिए कि आस-पड़ोस स्वच्छ रखना चाहिए और घर के आस पास पानी को एकत्रित होने से रोकना चाहिए।

2.7: पास पड़ोस/समुदाय में अस्वास्थ्यकर परिस्थितियों को बढ़ावा देने वाले कारक क्या हैं और पर्यावरण को स्वच्छ रखने के लिए क्या उपाय करने चाहिए?

केन्द्रित करें: अस्वास्थ्यकर परिस्थितियों के-कारण और उनकी रोकथाम

(कालाश 2-3)

अधिगम परिणाम	प्रस्तावित शिक्षण प्रक्रम	साधन एवं सामग्री
	क्रियाकलाप 1	
समुदाय मे स्वच्छता और स्वास्थ्य के बीच सम्बन्ध को पहचानना	छात्रों का ध्यान उनके पास-पड़ोस की ओर आकृष्ट कीजिए और पूर्वज्ञान का स्मरण निम्न प्रश्नों की सहायता से कराइए। तुम अपने घर कर कूड़ा-करकट कहां फेकते हो? (घर के बाहर कूड़ादान या उचित जगह में) क्या होगा यदि कूड़ेदान मे कूडा नही फेंका जाता है? (घर गन्दा हो जाएगा, मक्खी तथा विभिन्न रोग फैलेगें) तुम्हारे पड़ोसी कूड़ा-करकट कहां फैकते हैं? विभिन्न घरों का कूड़ा-करकट कहां संग्रह किया जाता है? ऐसे स्थानो पर तुम क्या देखते हो जहां कूड़ा-करकट खुले में इकट्ठा होता है? (वहां सूअर, कुत्ते, कौवे, पशु, मक्खी, मच्छर, आदि होगे) ऐसे स्थानों पर कैसी गन्ध आती है? (दुर्गन्ध) तुम खुले नाले/रुके हुए पानी के पास क्या देखते हो? (मच्छर, मक्खी) ऐसी स्थितियों का परिणाम क्या होगा? (मलेरिया, हैज़ा, मियादी बुखार, पेचिश जैसे रोग फैलेंगे) क्या होता है यदि लोग सड़को, बसों, सार्वजनिक स्थानों पर उल्टी करते अथवा थूकते है या खुली जगह शौच करते हैं? (इनसे क्षय, डिप्थीरिया, पेचिश, जैसे संक्रामक रोग फैलते है)	
	क्रियाकलाप 2	
पर्यावरण की स्वच्छता के लिये किए जाने वाले उपायों को पहचानना	'अस्वास्थ्यकर स्थितियो की रोकथाम कैसे की जाती है' के बारे में निम्न बिन्दुओं पर छात्रों से विचार विमर्श कीजिए। 1. आपका घर स्वच्छ होने के साथ ही पास-पड़ोस भी स्वच्छ होना चाहिए। कूड़ा-करकट सदैव ढक्कनदर कूड़ेदान में ही डालना चाहिए।	

2. लोगो को घरों के पास खुली जगह में मलत्याग करने से रोके।
3. सभी लोग मूत्रालय का उपयोग करे और सड़क पर मूत्रत्याग न करें।

क्रियाकलाप 3

उनसे कहिए कि विज्ञापन बनाएं तथा स्कूल एव अपने क्षेत्र में लगाएं।

विज्ञापन के शीर्षक

— कूड़ा-करकट ढक्कनदार कूड़ेदान में फेंकें
— सड़क पर न थूकिए
— अपने वातावरण को स्वच्छ रखिए तथा स्वस्थ्य रहिये, आदि

विस्तारण 1

छात्रो से कहिए कि स्कूल मे तथा पास-पडोस मे अपने बडे साथियों की सहायता से स्वच्छता सप्ताह मनाए।
यह समझने में छात्रों की सहायता कीजिए कि इन दो क्रियाकलापों द्वारा जनसाधारण में जागरूकता पैदा होगी और उन्हें आभास कराइए कि स्वच्छता तथा स्वस्थ पर्यावरण उनके लिए अति आवश्यक है।

विस्तारण 2

छात्रों को प्रोत्साहित कीजिए कि वे बोतलें, टिन, डिब्बे, ढक्कन आदि का संग्रह करके स्कूल में लाएं। इन्हें फूलदान, गुलदस्ता, कूड़ादान, थूकदान, पेनहोल्डर्स, चम्मच रखने का बर्तन आदि बनाने के लिए निर्देश दीजिए।
छात्रों को प्रोत्साहित कीजिए कि उतरे हुए फटे कपड़ों द्वारा वे गुड्डा, गुड़िया, मसखरा, मेजपोश, आदि वस्तुएं बना सकते हैं।

बोतले, टिन, डिब्बे, ढक्कन, फटे पुराने कपड़े

विस्तारण 3

गोबर गैस बनाने के लिए, गाय का गोबर लेकर उसमें बराबर मात्रा में पानी मिलाकर, मिश्रण को एक टिन मे ढक्कन से ढक कर 7-8 दिन तक के लिए रख दे। ढक्कन खोलने पर दुर्गन्ध आएगी। नजदीक के बायोगैस/गोबर गैस प्लान्ट को देखने के लिए जाइए।	गोबर गैस प्लान्ट का चित्र, गोबर, टिन, पानी

इकाई 3: मृदा-अपरदन और इसका संरक्षण
(मृदा संरक्षण)

प्रस्तावना

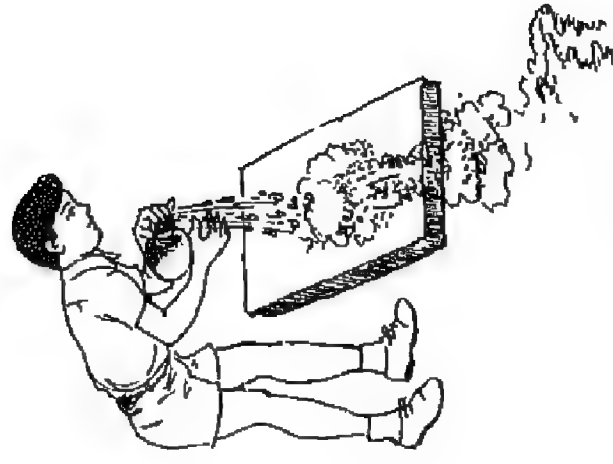
मृदा के निर्माण और उसके तीन प्रकारों (बलुई, दोमट और चिकनी) का अध्ययन कक्षा 4 मे कर चुके है। वे मृदा के तीनों प्रकारों मे समानताओं और विभिन्नताओ को जानने मे समर्थ हैं। उन्होंने मृदा संघटन के बारे मे भी अध्ययन कर लिया है और वे कम्पोस्ट एवम् रासायनिक उर्वरक डालकर और शस्यावर्तन (फसल-चक्र) द्वारा मृदा को उपजाऊ बनाने के विविध ढगों को जाने मे समर्थ है, ताकि उच्च उत्पादन हेतु उत्तम उपज प्राप्त हो। वे जानते हैं कि पैदावार में वृद्धि के लिये समुचित मौसम में बीज बोना, उचित प्रकार से सिंचाई करना और उर्वरक डालना तथा रोगो से सुरक्षित रखना आदि ऐसे कारक हैं, जो फसल की उपज को बढ़ाने में सहायक है।

इस इकाई मे छात्र.

— विभिन्न कारको को, जो मृदा-अपरदान में सहायक है, जानने;
— विभिन्न विधियों को जिनके द्वारा मृदा-संरक्षण होता है, जानने में, समर्थ होगे।

3.1: मृदा-अपरदन के कौन-कौन से विभिन्न कारक हैं?
केंन्द्रित करें: मृदा-अपरदन के कारण

(कालाश 3-4)

अधिगम परिणाम	प्रस्तावित शिक्षण प्रक्रम	साधन एवं सामग्री
	क्रियाकलाप 1	
मृदा-अपरदन के लिये जल के महत्व को पहचानना	छात्रों से कहिए कि एक छिछली ट्रे लेकर मृदा से भरे। ट्रे तिरछी करके उस पर बीकर से पानी डालें। पूछिए: तुम क्या देखते हो? अवलोकन कर यह निष्कर्ष निकालने में छात्रों की सहायता कीजिए कि जल मृदा के कणों पर बल लगाता है, जिससे वे ऊपर से नीचे की ओर बह जाते हैं। प्रकृति में वर्षा और बहते हुए जल से मृदा इसी प्रकार अपरदित (कट करके) हो कर बह जाती है।	छिछली ट्रे, बीकर, मृदा

बहता हुआ पानी मृदा कणों को बहा ले जाता है

क्रियाकलाप 2

जानना कि जल, नालियो द्वारा खेतो मे सिचाई के लिए अग्रसर होता है

छिछली ट्रे, बीकर, जल, मृदा

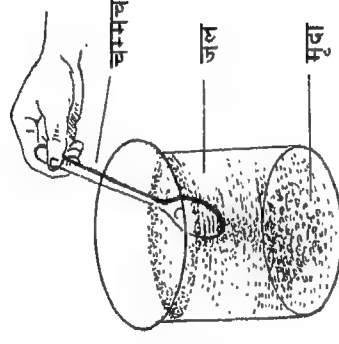
एक छात्र को छिछली ट्रे दीजिए। उसमे मृदा भरवाइए।
मृदा मे जल बहने के लिए नालियां बनवाइए। नाली में जल डालने को कहिए। अन्य छात्र अवलोकन करे।

पूछिए:
नाली मे तुम क्या परिवर्तन देखते हो, जिससे जल बह रहा है? (बहते जल के प्रभाव से ये चौड़ी हो गई हैं)
यह मृदा कहां जाती हैं?
(यह खेतों मे जाकर जम जाती है)
यदि सम्भव हो तो छात्रों को ऐसे खेत में ले जाएं जहां नालियों से जल पहुंचाया जाता है।

क्रियाकलाप 3

जानना कि बहता हुआ जल मृदा कणों को बहा कर एक स्थान से दूसरे स्थानों पर लें जाता है, जहां वे बैठ जाते है और जम जाते हैं

किसी छात्र से कहिए कि एक बीकर में थोड़ा पानी ले एवं दो चम्मच मृदा मिलाकर चम्मच से हिलाए। फिर इसे कुछ समय तक स्थिर रहने दें।

बीकर, मृदा, जल, चम्मच

पूछिए:
जब तुम चम्मच से लगातार विलोडन करते हो तब बीकर में क्या देखते हो?
(घूमते हुए जल में मृदा के कण तैरते रहते हैं)
जब तुम विलोडन बन्द कर देते हो तब क्या होता है?
(मृदा के कण बीकर की तली में बैठने लगते हैं)

छात्रों को बताइए कि पहाड़ों से आने वाली नदियां अपने साथ उपजाऊ मृदा के कण लाकर मैदान में छोड़ देती हैं, जिसके कारण वह बहुत उपजाऊ हो जाते हैं।

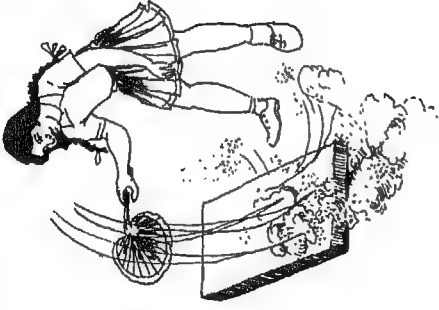
क्रियाकलाप 4

जानना कि तेज बहती वायु मृदा-कणों को एक स्थान से ले जाकर विभिन्न स्थानों पर जमा देती है

छात्रों से कहिए कि कागज पर कुछ मृदा का चूर्ण रखें। फिर, मुंह से फूकें अथवा हाथ के पंखें से हवा करें।

कागज, मृदा, हाथ का पंखा

पूछिए:
तुम क्या देखते हो?
मृदा कणों के फैल जाने का क्या कारण है?

ये मृदा कण कहां जाते हैं?
यह निष्कर्ष निकालने में छात्रों की सहायता कीजिए कि सतह के उपजाऊ मृदा कण जो कि हल्के और ढीले होते हैं, वायु के झोंको से उड़ जाते हैं।

बहती हुई मृदा कणों को बहा ले जाती है

रेत के टीले

मरुस्थल में रेत के टीले का चित्र

उस क्रियाकलाप का स्मरण दिलाइए जिसमें हम चूर्ण मृदा को हाथ के पंखे से हवा देकर उड़ाते हैं।
क्या होता है जब हम चूर्ण मृदा पर पंखे से हवा करते हैं?
(यह हवा की गति के साथ उड़ जाती है)
मरुस्थल में रेत के टीले का चित्र दिखाएं और छात्रों को बताएं कि ये टीले वायु द्वारा रेत को उड़ा कर लाने और एक-ही स्थान पर जमा होने से बनते हैं।

क्रियाकलाप 5

जानना कि वन अपरोपण (वृक्षों के काटे जाने) से मृदा का अपरदन (क्षरण) होता हैं

पूछिए:
क्या होता है जब तुम घास के मैदान पर एक निश्चित स्थान पर बार-बार चलते हो?
(वहां की घास दब जाती है और कुछ समय बाद सूख जाती है जिससे वहां की मृदा उखड़ कर टूट जाती

है या दरार पड़ जाती है)
ऊपरी मृदा के कणों पर तेज वर्षा अथवा आंधी का क्या प्रभाव पड़ेगा?
(मृदा कण वहां से बहते पानी या पवन द्वारा दूसरी जगह चले जायेंगे)
छात्रों को बताइए कि प्रकृति में पौधे, वृक्ष, घास, फसल आदि, मृदा-कणों को बांधे रखते हैं, जिससे वे मृदा के अपरदन को रोकते हैं। जड़ के कार्यों का स्मरण कराइए।

पूछिए:
लकड़ी का उपयोग हम कहां-कहां करते हैं?
जंगलों से लकड़ी कैसे प्राप्त की जाती है?
छात्रों को बताएं कि जंगलों में वृक्ष काटना 'वन-अपरोपण' कहलाता है। यह, घरेलू कामों के लिये लकड़ी प्राप्त करने के लिए, या कृषि की भूमि के क्षेत्र को बढ़ाने के लिए, अधिकतर किया जाता है।
वन-अपरोपण हमारे जीवन को किस प्रकार प्रभावित करता है?
वन-अपरोपण के और कौन-कौन से परिणाम होते है?
छात्रों को बताइए कि वन-अपरोपण से मृदा-अपर्दन होता है, जिससे हरी भरी भूमि बंजर (ऊसर)/ अपरद भूमि में बदल जाती है।

पूछिए:
यदि वन-अपरोपण पूर्ण रूप से बन्द नहीं हो सकता है तो वन क्षेत्र की भूमि को सुरक्षित रखने के कौन-कौन से उपाय हैं?
(वन-अपरोपण प्रतिबंधित किया जाय और यदि पूर्णतः प्रतिवन्ध सम्भव न हो तो वन विकास हेतु समय-समय पर वृक्षारोपण कराया जाए)
हमें 'वनमहोत्सव' मनाने को क्यों कहा जाता है?

विस्तारण 1

छात्रों से कहिए कि वे विद्यालय अथवा पास-पड़ोस में और अधिक पौधे उगाएं।

3.2: मृदा को संरक्षित करने की कौन-कौन सी विधियां है?

केंन्द्रित करें: मृदा संरक्षण की आवश्यकता तथा विधियां

(कालांश 3-4)

अधिगम परिणाम	प्रस्तावित शिक्षण प्रक्रम	साधन एवं सामग्री
	क्रियाकलाप 1	
मृदा संरक्षण की आवश्यकता को जानना	छात्रों को वाटिका में अथवा पड़ोस के मैदान में ले जाइए और उनसे कहिए कि वे भूमि के एक टुकड़े को चुने और भूमि को दो भागों में विभाजित करें। एक भाग की ऊपरी मृदा को खुरच कर हटाएं तथा दूसरे भाग को ऐसे ही रहने दें। दोनों भागों में भिगोई हुई राई के बीज बोएं। दोनों की उचित सिंचाई नियमित रूप से करें। छात्रों से कहिए कि तीन दिन तक समय-समय पर बीजों का अवलोकन करें। पूछिए: बीज कब अंकुरित हुए? (दो/तीन दिन में) छात्रों से दोनों भागों में पौधों की वृद्धि का निरीक्षण 15 दिन तक कराइए। पूछिए: दोनों भागों के पौधों की वृद्धि में क्या अन्तर है? किस भाग के पौधे अधिक स्वस्थ हैं? छात्रों को बताइएं कि आंधी तथा तेज बहते जल से उपजाऊ भूमि की ऊपरी मृदा बह जाती है, जिससे भूमि की उर्वरता कम हो जाती है। इसका अर्थ यह है कि प्रकृति की अत्यन्त उपयोगी वरदानों में, मृदा है जिसका संरक्षण अति आवश्यक है। ऊपरी मृदा को अपरदन से बचाने के लिए अपरदन कारक जैसे बहते हुए जल, आंधी आदि से रक्षा करने को मृदा संरक्षण कहते हैं।	राई के बीज
	क्रियाकलाप 2	
मृदा-संरक्षण की विभिन्न विधियों को पहचानना	वाटिका में उगते हुए स्वस्थ पौधों की ओर छात्रों का ध्यान आकर्षित कीजिए। पूछिए: वाटिका में पौधों की स्वस्थ वृद्धि के क्या कारण हैं?	

छात्रों को पूर्व में किये गए राई के बीजों के साथ क्रियाकलाप 3.2.1 का स्मरण कराइए, जिसमें ऊपरी मृदा हटा ली गई थी।
ऊपरी मृदा को हटाने से पौधों की वृद्धि पर क्या प्रभाव पड़ता है?
यह निष्कर्ष निकालने में छात्रों की सहायता कीजिए कि वाटिका में पौधे के स्वस्थ होने का एक कारण वाटिका की मृदा का अक्षत (बिना अपरदन) रहना भी है।

ऊपरी मृदा अक्षत क्यों बनी रहती है?
(पौधों को सावधानी पूर्वक सींचने से यह अक्षत बनी रहती है। वाटिका की परिसीमाएं भी वाटिका की ऊपरी मृदा को अक्षत रखती है)।

छात्रों को बताइए कि अपरदन के कारकों जैसे आंधी एवं तेज बहाव के जल इत्यादि की गति धीमी कर देने से भी मृदा-अपरदन को काफी हद तक रोका जा सकता है। इस प्रकार मृदा को कम क्षति पहुंचेगी और मृदा भी संरक्षित होगी।

क्रियाकलाप 3

मृदा संरक्षण में वृक्ष, घास तथा पौधों की भूमिका पहचानना

दो ट्रे, घास के साथ लगी मृदा बिना घास लगी मृदा, बीकर, दो कटोरिया

मैदान से दो 15 से.मी. x10 से.मी.x5 से.मी. आकार की मृदा का ढेला खोद लीजिए, इनमें से एक में घास उगी हो तथा दूसरे में घास न हो। दो ट्रे 'क' तथा 'ख' लीजिए और ट्रे 'क' में घास युक्त मृदा तथा ट्रे 'ख' में घास विहीन मृदा रखिए। बहते पानी के नीचे दोनों ट्रे को टेढ़ी रखवाइए या बीकर से पानी डलवाइएं। एक कटोरी ट्रे 'क' के नीचे तथा दूसरी कटोरी ट्रे 'ख' के नीचे रखिए। छात्रों से कहिए कि दोनों ट्रे की मृदा का तथा दोनों कटोरी के पानी का निरीक्षण करें।

पूछिए:
किस कटोरी में जल अधिक गंदला है?
किस ट्रे से अधिक मृदा बह कर कटोरी में आ गई है?
यह निष्कर्ष निकालने में छात्रों की सहायता कीजिए कि वृक्ष, घास तथा पौधे मृदा संरक्षण में सहायक होते हैं क्योंकि इनकी जड़े मृदा कणों को पकड़े रहती हैं।

(जड़ों के कार्यों का स्मरण कराइए)

पौधे मृदा-संरक्षण में सहायक होते हैं

क्रियाकलाप 4

पहचानना कि बन्ध तथा तटबन्ध किस ढंग से भूमि-संरक्षण में सहायक होते हैं

बांध का चार्ट

छात्रों का ध्यान वर्षा ऋतु में नालियों में अधिप्रवाहित जल की ओर आकर्षित कीजिए।

पूछिए:
नाली के अधिप्रवाहित जल को कैसे रोका जा सकता है?
(नाली की दीवारें ऊंची करके)
अपने देश में प्रतिवर्ष बाढ़ से होने वाली क्षति के बारे में छात्रों से विचाार विमर्श कीजिए।

पूछिए:
बाढ़ को कैसे रोका जा सकता है?
(नदियों के किनारे पत्थर की दीवारें खड़ी करके तथा किनारे-किनारे वृक्षारोपण करके)

नदी तट/पत्थर की दीवार प्रदर्शित करने वाला चार्ट

स्पष्ट करिए कि नदियों के किनारों पर पानी का अत्यधिक दाब रहता है और इसीलिए नदियों के किनारों तथा पास के खेतों की मृदा, पानी अपने साथ बहा ले जाता है। बन्ध तथा तटबन्ध बाढ़ के पानी को रोककर मृदा अपरदन को रोक सकते हैं। चार्ट की सहायता से उन्हें दिखाइए कि नदियों के किनारे पत्थरों की दीवार (तटबन्ध) वर्षा ऋतु से बाढ़ के पानी को भी रोकती हैं। इस प्रकार ये भूमि संरक्षण में सहायक है। यह बहते पानी द्वारा होने वाले नुकसान को भी रोकते है।

क्रियाकलाप 5

ढालों के सीढ़ीनुमा (वेदिकाकरण) के लाभों से अवगत होना

छात्रों से कुछ गीली मिट्टी लेने को कहिए और फर्श पर दो गीली मिट्टी की पहाड़ियां बनवाइए एक पहाड़ी को सीढ़ीनुमा काटें, इसी को वेदिकाकरण कहते हैं। इस पहाड़ी की सीढ़ियों पर राई के बीज बोइए और दो दिनों तक नियमित सींचिए। कुछ दिनों के पश्चात राई के बीज अंकुरित हो जावेगें। अब दोनों पहाडियों पर समान दाब पर पानी छोड़िए।

गीली मिट्टी, राई के बीज, जल, बीकर

पूछिए:

तुम क्या देखते हो?

अवलोकन करने में छात्रों की सहायता कीजिए कि ढलानों पर जहां पर सीढ़ीनुमा खेत तथा पौधे नहीं होते वहाँ बहते हुए जल के कारण मृदा का अपरदन होता है। दूसरी ओर जहां टीलों पर सीढ़ीनुमा क्यारियां होती है वहां जल धीरे-धीरे नीचे आता है। पहाड़ी क्षेत्रों में मृदा की रक्षा करने के लिए ऐसा किया जाता है। यदि आस-पास सीढ़ीनुमा खेती होती है तो उसे छात्रों को दिखाया जाए। अन्यथा सीढ़ी नुमा खेती का चार्ट दिखाएं।

सीढ़ीनुमा खेती की चार्ट

खेतों को सीढ़ी नुमा बनाने से मृदा संरक्षण होता है

क्रियाकलाप 6

नालियां बनाने से मृदा संरक्षण में होने वाले लाभों को जानना

छात्रों से कहिए कि गीली मिट्टी के टीले बनाएं। उन में उंगलियों से नालियां (खाँचे) बनाएं, समूचे टीले पर राई के बीज बोएं। जब तीसरे दिन बीज अंकुरित हो जाएं तब समूचे टीले पर जल डालें।

गीली मिट्टी, राई के बीज [illegible] वाली युक्त खेत का चार्ट

पूछिए:
तुम क्या देखते हो?

यह निष्कर्ष निकालने में छात्रों की सहायता कीजिए कि अधिकतर जल नालियों (खांचों) से बह जाता है, जिससे मृदा कण अपने स्थान पर सुरक्षित बने रहते है और शेष टीले पर मृदा संरक्षित रहती है:

नाली-युक्त खेत

क्रियाकलाप 7

पास-पड़ोस में मृदा अपरदन की रोकथान के लिए किए गए उपायों को पहचानना

पास-पड़ोस में मृदा अपरदन को रोकने के लिए, किये गये उपायों से अवगत कराइये।

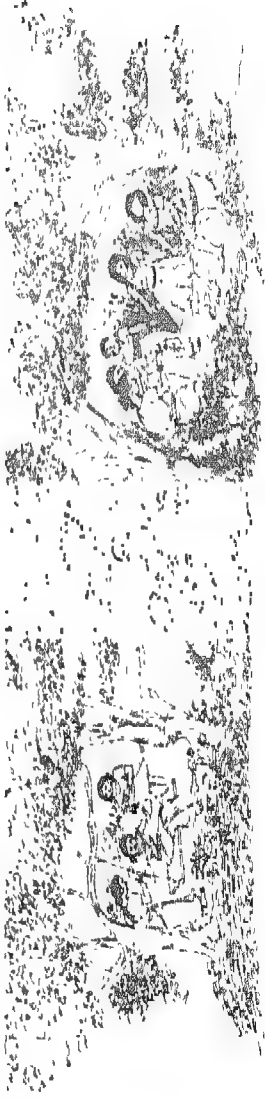
1. छात्रों से पोस्टर बनवाइए तथा निम्नलिखित नारे लिखवाएं।
   वृक्षों का काटना टालिए।
   मवेशियों तथा अन्य जन्तुओं द्वारा अत्यधिक चरने से पौधों को नष्ट न होने दें क्योंकि ये मृदा का अपरदन भी करते हैं।

घास पर न चलें।

छात्रों से ऐसे सूचना पट्ट बनवा कर उनके परिवेश में, जहां लॉन सम्पोषित किया जाता है, को रखवाइये।

2. छात्रों को प्रोत्साहित कीजिए कि अपने इलाके में वृक्षारोपण करें और अन्य उचित पौधे भी लगाएं।
3. बढ़ती हुई मरुस्थलीय स्थितियों की रोकथाम हेतु सड़कों के किनारे तथा कम वर्षा वाले स्थानों पर छात्रों से ऐसे पौधे लगवाइए, जिन्हें जल की कम आवश्यकता होती है।
4. छात्रों से कहिए कि यदि उनके क्षेत्र में वर्षा जल का निकास अनुपयुक्त है तो स्थानीय अधिकारियों को सूचित करें।
5. पालतू मवेशियों द्वारा अधिक चरने तथा हरे पौधों एवं वृक्षों के काटे जाने पर होने वाले दुष्प्रभावों से जनता को अवगत कराएं।

विस्तारण 1

मृदा संरक्षण, वन महोत्सव, जैसे विषयों पर लेख तथा भाषण प्रतियोगिता आयोजित कीजिए जिससे छात्र मृदा संरक्षण के लाभ और मृदा अपरदन की हानियों के महत्व का मूल्यांकन करने में प्रोत्साहित हों।

इकाई 4: वायु और इसकी उपयोगिता
(वायु-इसका प्रदूषण एवं इसके उपयोग)

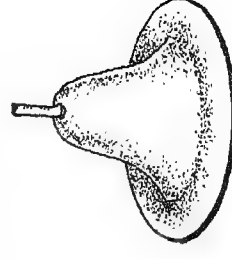
प्रस्तावना

छात्र अपने चारों ओर विद्यमान वायु के गुणों से भलीभांति परिचित हैं। उन्हें श्वसन क्रिया तथा वायु में उपस्थित आक्सीजन के महत्व का भी ज्ञान है।

इस इकाई द्वारा छात्र:
- वायु के गुणों का उल्लेख करने,
- वायु में विभिन्न गैसों के नाम तथा उनकी उपयोगिता बताने,
- शुद्ध और प्रदूषित वायु में विभेद करने
- शुद्ध वायु की आवश्यकता समझने में, समर्थ होंगे।

4.1: हमें यह ज्ञान कैसे होता है कि वायु दाब डालती है?
केंन्द्रित करें: वायु द्वारा आरोपित दाब

(कालांश 2-3)

अधिगम परिणाम	प्रस्तावित शिक्षण प्रक्रम	साधन एवं सामग्री
	क्रियाकलाप I	
वायु दाब की पहचान कराना	एक छात्र को एक "रबर चूषक" देकर उसे निम्नलिखित निर्देश दीजिए तथा कक्षा के सम्पूर्ण छात्रों को उसके द्वारा किए जाने वाले क्रियाकलापों को ध्यान से देखने के लिए कहिए। रबर चूषक को मेज की चिकनी कठोर सतह पर दबाओ। अब इसे ऊपर खींचने का प्रयास करो। अन्य छात्रों द्वारा भी उपयुक्त क्रियाकलाप कराइए। पूछिए: रबर चूषक को ऊपर खींचते समय तुम क्या अनुभव करते हो? रबर चुषक को ऊपर की ओर खींचना कठिन क्यों होता है? यह निष्कर्ष निकालने में छात्रों की सहायता कीजिए कि रबर चूषक को दबाने पर उसके अन्दर की अधिकांश वायु निकल जाती है। उसकी बाहरी सतह पर अन्दर की अपेक्षा वायु दाब अधिक हो जाने के कारण इसे ऊपर की ओर खींचना कठिन हो जाता है।	रबर नकल (चूषक), पानी, डेसीमीटर घनाकार पात्र रबर चूषक

छात्रों द्वारा उपर्युक्त क्रिया कलाप को, रबर चूषक को डेसीमीटर घनाकार पात्र के अन्दर जिसमें थोड़ा जल हो, इसकी पेंदी के तल को दबाकर और तत्पश्चात ऊपर खींचकर पुनः कराइए।

पूछिए:
रबर चूषक को ऊपर खींचने पर क्या होता है?
रबर चूषक को दबाने पर क्या देखते हो?
(वायु के बुलबुले पानी से बाहर निकलते दिखाई देते हैं)

किसी छात्र से एक गिलास लेकर उसे अपने मुंह के समीप आकर अपना मुंह ढक लेने को कहिए। उसे इसके अन्दर की वायु चूसकर अपनी श्वास (सांस) कुछ क्षण तक रोकने दीजिए। तत्पश्चात उसे अपना हाथ गिलास से हटाने को कहिए।

गिलास, पानी

अन्य छात्रों द्वारा भी उपर्युक्त क्रियाकलाप कराइए।

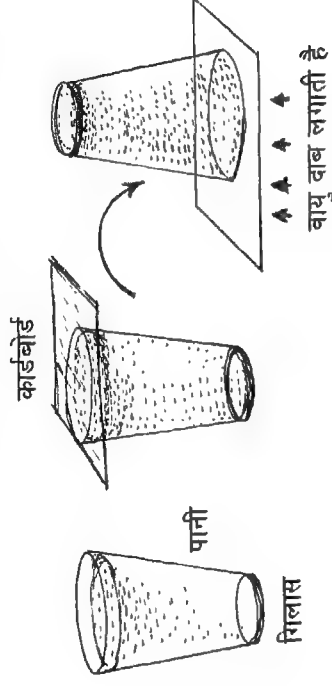
पूछिए:
क्या गिलास नीचे गिर जाती है?
गिलास मुंह से नीचे क्यों नहीं गिरती है?

यह समझने में छात्रों की सहायता कीजिए कि गिलास के अन्दर की वायु चूसने से गिलास के अन्दर वायु दाब कम हो जाता है। गिलास के बाहर वायु दाब अपरिवर्तित रहता है और यह अन्दर के वायु दाब से अधिक होने के कारण गिलास को मुंह से नीचे गिरने से रोके रहता है।

एक छात्र को गिलास देकर उससे इसे पानी से पूरा भरकर तथा इसके खुले सिरे के किनारों को पानी से भिगोकर इसके मुंह को एक साफ मोटे कागज के टुकड़े से ढकने को कहिए।
गिलास के खुले सिरे पर मोटे कागज के टुकड़े को हथेली से दबाकर इसे धीरे-धीरे उलटवाइए ताकि इसका बन्द सिरा ऊपर हो जाय।
छात्र से कहिए कि अपनी हथेली गिलास के मुंह से हटाए। उपर्युक्त क्रियाकलाप अन्य छात्रों से भी कराइए तथा पूछिए:
तुम क्या देखते हो?

गिलास, पानी, मोटा कागज

गिलास से पानी नीचे क्यों नहीं गिरता है?

यह निष्कर्ष निकालने में छात्रों की सहायता कीजिए कि गिलास के मुंह पर रखे मोटे कागज के टुकड़े पर अन्दर की अपेक्षा बाहरी वायु के दाब की अधिकता के कारण पानी नीचे नहीं गिरता है।

4.2: हम वायु का उपयोग गुब्बारे जैसी वस्तुओं को फुलाने में तथा द्रवों को गतिशील करने में कैसे करते हैं?

केन्द्रित करें: फुलाने तथा द्रवों को गतिशील करने में वायु का उपयोग

(कालांश 1-2

अधिगम परिणाम	प्रस्तावित शिक्षण प्रक्रम	साधन एवं सामग्री
	क्रियाकलाप 1	
यह पहचानना कराना कि वायु में वस्तुओं को फुलाने का गुण होता है	कक्षा के कुछ छात्रों को कुछ गुब्बारे दीजिए और उनसे मुंह से हवा भरने को कहिए। तुम क्या देखते हो? (गुब्बारे फूल जाते हैं) वायु से फुलाई जाने वाली कुछ अन्य वस्तुओं के नाम बताओं। यह निष्कर्ष निकालने में छात्रों की सहायता कीजिए कि वायु का उपयोग फुटबाल ब्लेडर, हवा का तकिया, स्कूटर, कार, ट्रक आदि के ट्यूब फुलाने में किया जाता है।	

कक्षा के किसी छात्र को निर्देश दीजिए कि एक गुब्बारे में मुंह से उस समय तक हवा भरे जब तक कि वह फट न जाय।

पूछिए:
गुब्बारा क्यों फट जाता है?
(गुब्बारे के अन्दर वायु के दाब की अधिकता के कारण)

यह निष्कर्ष निकालने में छात्रों की सहायता कीजिए कि गुब्बारा, साइकिल, स्कूटर आदि के ट्यूब को फुलाते समय आवश्यकता से अधिक हवा नहीं भरनी चाहिए।

यह पहचाना कराना कि वायु-दाब द्रवों को गतिशील कर सकती है

गिलास, स्ट्रा पाइप अथवा कांच की पतली नली, पानी, बीकर, पोटेशियम परमैंगनेट

कक्षा के किसी छात्र से कहिए कि एक गिलास अथवा बीकर में पौटेशियम परमैंगनेट डालने से बना रंगीन पानी भरकर उसमें एक स्ट्रा पाइप अथवा कांच की पतली नली रखें।

उससे कहिए कि स्ट्रा पाइप अथवा कांच की पतली नली द्वारा वायु चूसे।

पूछिए:
क्या होता है जब तुम स्ट्रा पाइप अथवा कांच की पतली नली द्वारा वायु चूसते हो?
स्ट्रा पाइप अथवा कांच की पतली नली में पानी ऊपर क्यों चढ़ जाता हैं?

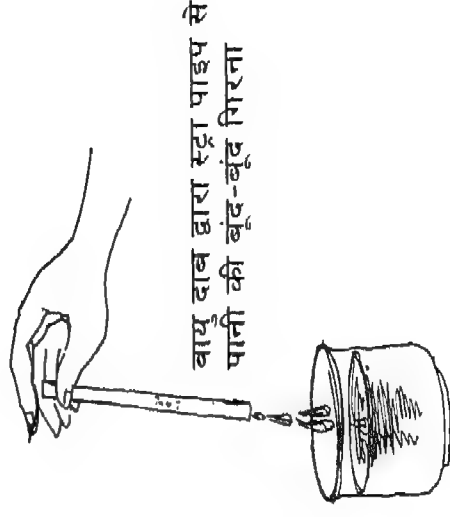
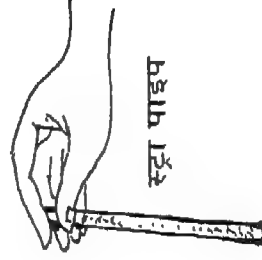
यह निष्कर्ष निकालने में छात्रों की सहायता कीजिए कि स्ट्रा पाइप अथवा कांच की नली द्वारा वायु चूसने पर उसके अन्दर की वायु का दाब कम हो जाता है। स्ट्रा पाइप अथवा कांच की नली के बाहर पानी की सतह पर वायु दाब का आधिक्य पानी को ऊपर की ओर धक्का देता है जिससे उसमें पानी ऊपर चढ़ जाता है।

कक्षा के किसी दूसरे छात्र से कहिए कि उपर्युक्त की भांति स्ट्रा पाइप अथवा कांच की नली द्वारा पानी चूसकर इसके ऊपरी सिरे को अपनी अंगुली से बंद कर इसे पानी से बाहर निकाले।

पूछिए:
तुम क्या देखते हो? (पानी नली के अन्दर रुका रहता है)
अब छात्र से नली के ऊपरी सिरे पर अंगुली को थोड़ा ढ़ीला कर दबाव कम करने को कहिए तथा पूछिए:

अब क्या देखते हो?

(पानी बूंद-बूंद बाहर गिरने लगता है)
क्या होता है जब नली का ऊपरी सिरा खुला छोड़ दिया जाता है?
(नली के अन्दर का सम्पूर्ण पानी बाहर आ जाता है)
नली के अन्दर का सम्पूर्ण पानी बाहर क्यों आ जाता है?

यह निष्कर्ष निकालने के लिए छात्रों को प्रोत्साहित कीजिए कि नली के ऊपरी सिरे पर अंगुली थोड़ी सी ढीली करने पर कुछ वायु नली के अन्दर प्रवेश कर जाती है और इसके अन्दर का वायु दाब थोडा अधिक हो जाता है, जिससे पानी नली के निचले सिरे से बूंदों के रूप में नीचे गिरता है। जब नली का ऊपरी सिरा पूर्ण रूप से खुला रखा जाता है तो अधिक वायु नली के अन्दर प्रवेश कर जाती है और नली के निचले सिरे से सम्पूर्ण पानी बाहर गिर जाता है। वायु दाब के कारण ही पानी नीचे गिरता है। दैनिक जीवन की उन परिस्थितियों को छात्रों द्वारा प्रकाश में लाइए जिनमें वायु के इस गुण का उपयोग किया जाता है।

वायु दाब से द्रव का गतिशील होना

विस्तारण I

किसी छात्र को निम्नलिखित क्रियाकलाप को कहिए।

टिन का एक डिब्बा (पाउडर का डिब्बा, डालडा का डिब्बा अथवा कोई अन्य टिन का डिब्बा) लो, जिसके दोनों सिरे बन्द हों।

डिब्बे की ऊपरी सतह अथवा ढक्कन पर एक छोटा छिद्र और नीचे की सतह (तल में) में 8-10 छोटे छिद्र बनाओ।

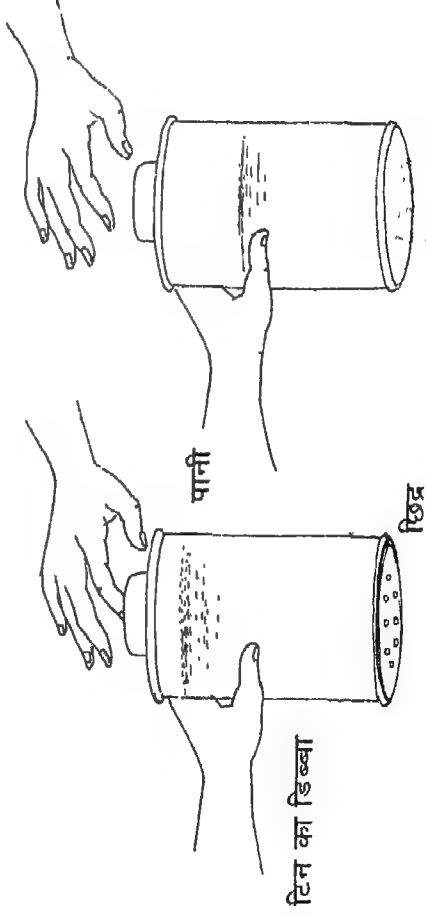
इस टिन के डिब्बे को पानी से भरी बाल्टी में डुबाओ।

डिब्बे के ऊपरी सतह अथवा ढक्कन के छिद्र को अपनी अंगुली से बंद करके इसे बाहर निकालो।

छात्र से कहिए कि अपनी अंगुली को डिब्बे के छिद्र से कुछ क्षण के लिए हटाकर पुनः बन्द करे। अन्य छात्रों से कहिए कि इस क्रियाकलाप को दो या तीन बार दोहराएं।

पूछिए:

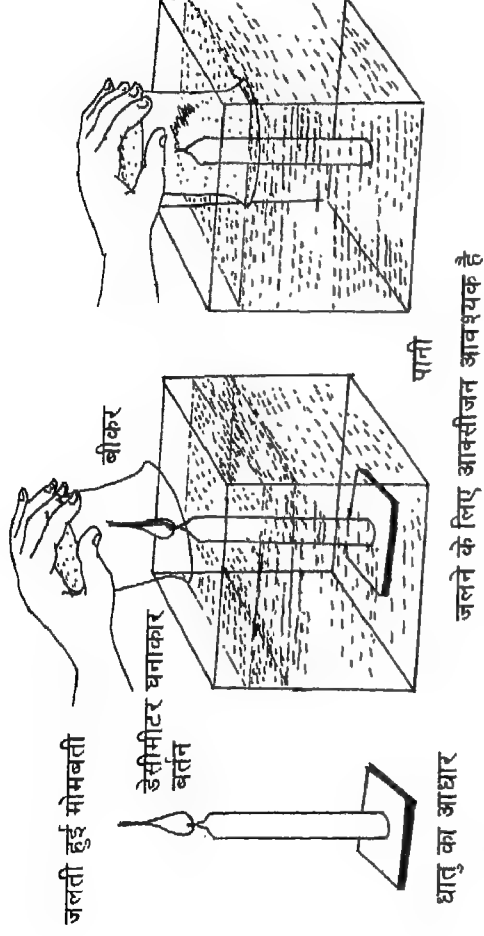
क्या होता है जब अंगुली हटाकर डिब्बे के ऊपरी छिद्र को कुछ क्षण के लिए खुला रखा जाता है?
क्या होता है जब ऊपरी छिद्र को अंगुली से पुनः बन्द कर दिया जाता है?
ऊपरी छिद्र को खुला रखने पर पानी बाहर क्यों निकल जाता है?

हथौड़ा, टिन बकस, पानी, लोहे की कील, बाल्टी

यह निष्कर्ष निकालने में छात्रों की सहायता कीजिए कि ऊपरी छिद्र को खुला रखने पर पानी वायु दाब के कारण तली से बाहर निकल जाता है। छात्रों को चाय की केतली से सम्बन्धित अनुभव का स्मरण दिलाइए। उनका ध्यान इस तथ्य की ओर आकर्षित कीजिए कि चाय की केतली के ढक्कन में छिद्र न होने पर इससे चाय को दूसरे बर्तन में सुविधापूर्वक उंडेला नहीं जा सकता।

4.3: वायु में कौन-कौन सी गैसें विद्यमान हैं और वे हमारे लिए किस प्रकार महत्वपूर्ण हैं?
केन्द्रित करें: वायु में विद्यमान विभिन्न गैसें और उनका उपयोग

(कालांश 2-3)

अधिगम परिणाम	प्रस्तावित शिक्षण प्रक्रम	साधन एवं सामग्री
	क्रियाकलाप 1	
वायु में विद्यमान विभिन्न गैसों के नाम से परिचित कराना	वायु के विषय में निम्नलिखित प्रश्नों द्वारा छात्रों के पूर्व ज्ञान का स्मरण कराइए। श्वास (सांस) लेते समय रक्त द्वारा कौन-सी गैस अवशोषित होती है? (आक्सीजन) श्वास (सांस) छोड़ते समय कौन-सी गैसे बाहर निकलती है? (कार्बनडाइ-आक्साइड) वायु में कौन-कौन सी गैस विद्यमान हैं? (आक्सीजन, कार्बनडाइ-आक्साइड, नाइट्रोजन, कुछ अन्य गैस तथा जल-वाष्प) किसी छात्र से कहिए कि डेसीमीटर घनाकार बर्तन में एक जलती हुई मोमबत्ती एक धातु के गुटके पर चित्रानुसार रखे। बर्तन में थोड़ा-सा पानी डालें और मोमबत्ती को एक बीकर से इस प्रकार ढकें ताकि बीकर का मुंह पानी में डूबा रहे।	[illegible] दो [illegible] काच का गिलास, दियासलाई
पहचान कराना कि जलने में आक्सीजन प्रयुक्त होती है	किसी दूसरे छात्र से कहिए कि एक दूसरी मोमबत्ती जलाकर इसके समीप रखे। कक्षा के सम्पूर्ण छात्रों को ध्यान से देखते रहने को कहिए कि जलती मोमबत्ती का क्या होता है। पूछिए: तुम क्या देखते हो? (बीकर के अन्दर की मोमबतत्ती कुछ समय पश्चात बुझ जाती है परन्तु दूसरी मोमबत्ती जलती रहती है) कुछ समय पश्चात जलती मोमबत्ती क्यों बुझ जाती है? (वायु की आपूर्ति समाप्त हो जाने के कारण) तुम क्या निष्कर्ष निकालते हो?	

जलने के लिए आक्सीजन आवश्यक है

यह निष्कर्ष निकालने में छात्रों की सहायता कीजिए कि वायु का एक भाग सक्रिय होता है जो वस्तुओं को जलाने में सहायक है। बीकर के अन्दर बन्द वायु का जब यह सक्रिय भाग समाप्त हो जाता है तो मोमबत्ती का जलना बन्द हो जाता है। वायु के इस सक्रिय भाग को आक्सीजन कहते हैं।

गिलास/बीकर में पानी के तल में कुछ समय पश्चात क्या परिवर्तन होता है?

(गिलास/बीकर में पानी का तल उठ जाता है)

कुछ समय पश्चात गिलास/बीकर में पानी का तल ऊपर क्यों उठ जाता है?

यह पहचान कराना कि कार्बनडाइ आक्साइड पानी में घुल जाती है

छात्रों को स्पष्ट कीजिए कि मोमबत्ती के जलने में आक्सीजन प्रयुक्त होती है और कार्बनडाइ-आक्साइड बनती है जो पानी में घुल जाती है। इसका स्थान लेने के लिए पानी का तल ऊपर उठ जाता है।

वायु में कार्बनडाइ-आक्साइड की उपस्थिति की पहचान कराना

किसी छात्र से कहिए कि निम्नलिखित क्रियाकलाप करे। एक कांच के गिलास/बीकर में दो चम्मच चूना लो। गिलास को दो तिहाई पानी से भर लो।

गिलास में लिए गए चूने और पानी को चम्मच से हिलाओ और इसे स्थिर होने दो।

चूना, पानी, कांच के दो गिलास, चम्मच, दो बीकर

स्वच्छ द्रव को एक दूसरे कांच के गिलास में निथार लो।
(यह स्वच्छ द्रव चूने का पानी है)

चूने के पानी को खुली हवा में रख दो।
छात्रों से कहिए कि दूसरे दिन चूने के पानी को ध्यानपूर्वक देखें

पूछिए:
चूने के पानी को खुली हवा में अधिक देर तक रखने पर क्या होता है?
(चूने का पानी दूधिया हो जाता है)

चूने का पानी दूधिया क्यों हो जाता है?

यह निष्कर्ष निकालने में छात्रों की सहायता कीजिए कि वायु में कार्बनडाइ-आक्साइड विद्यमान है, जो चूने के पानी को दूधिया कर देती है।

क्रियाकलाप 3

आक्सीजन, नाइट्रोजन और कार्बनडाइ-आक्साइड की उपयोगिता का उल्लेख करना

छात्रों को उनके अनुभव का स्मरण दिलाइए और पूछिए:
दैनिक जीवन में आक्सीजन की क्या उपयोगिता है?
(वस्तुओं को जलाने में तथा श्वसन किया में प्रयुक्त होती है)

यह निष्कर्ष निकालने में की छात्रों की सहायता कीजिए कि आक्सीजन का प्रयोग गोताखोरों एवं पर्वातारोहियों द्वारा किया जाता है। इसका प्रयोग रोगी भी करते हैं।
दिन में पौधे वायुमंडल की किस गैस का प्रयोग करते हैं?
(कार्बनडाइ-आक्साईड)
कार्बनडाइ-आक्साइड के और कौन-कौन से उपयोग हैं?

छात्रों को इस तथ्य से अवगत कराइये कि कार्बनडाइ-आक्साइड का उपयोग सोडा-वाटर, आदि वालित पेय तैयार करने में किया जाता है। इसका उपयोग आग बुझाने में भी किया जाता है।

पूछिए:
नाइट्रोजन का क्या उपयोग है?
छात्रों को इस तथ्य से अवगत कराइए कि नाइट्रोजन का उपयोग उर्वरकों के उत्पादन, में किया जाता है।

	उर्वरक क्या है? (उर्वरक कुछ रसायनिक पदार्थ होते हैं, जो पौधों के बढ़ने तथा उनके विकास मे सहायक होते हैं) उर्वरक के कुछ उदाहरण दो। (यूरिया, अमोनियम सल्फेट) टिप्पणी: छात्रों को यूरिया और अमोनियम सल्फेट के नमूने दिखाइए।	

4.4: हम शुद्ध वायु और प्रदूषित वायु में विभेद कैसे करते हैं?

(कालांश 1-2)

अधिगम परिणाम	प्रस्तावित शिक्षण प्रक्रम	साधन एवं सामग्री
शुद्ध वायु तथा प्रदूषित वायु में विभेद कराना	छात्रों को उनके दैनिक जीवन के अनुभवों का निम्नलिखित प्रश्नों के माध्यम से स्मरण कराइए। तुम कैसा अनुभव करते हो जब तुम्हारे आस-पास की वायु जलते उपलों, कोयलों, लकड़ी अथवा उद्योगशाला के धुंए से भर जाती है? (घुटन और चिड़चिड़ाहट की अनुभूति होती है) घुटन का कारण क्या है? खुले उद्यान अथवा मैदान में तुम कैसा अनुभव करते हो? (ताजगी की अनुभूति होती है) ताजगी की अनुभूति का क्या कारण है? छात्रों को इस तथ्य से अवगत कराएं कि धुएं की उपस्थिति से वायु प्रदूषित हो जाती है, जिससे घुटन अथवा चिड़चिड़ाहट की अनुभूति होती है। खुले मैदान अथवा उद्यान में वायु प्रदूषण रहित (शुद्ध) होती है, इसलिए वहां ताजगी की अनुभूति होती है। वायु प्रदूषण के अन्य क्या-क्या कारण है?	
प्रदूषण उत्पन्न करने वाले कारकों को यह पहचानना	विचार विमर्श द्वारा छात्रों को इस तथ्य से अवगत कराइए कि कारखानों की चिमनियों, पेट्रोल/डीजल कार/ट्रक के इन्जिन से निकलने वाले धुएं मे वायु प्रदूषित हो जाती है। पौधों और पशुओं के क्षय के दौरान निकलने वाली गैसों से भी प्रदूषण होता है।	

4.5: हम कैसे पहचान करते हैं कि प्रदूषित वायु हमारे लिए हानिकारक है और शुद्ध वायु अच्छे स्वास्थ्य के लिए आवश्यक है?

केन्द्रित करें: वायु और स्वास्थ्य

(कालांश 1-2)

अधिगम परिणाम	प्रस्तावित शिक्षण प्रक्रम	साधन एवं सामग्री
	क्रियाकलाप :	
प्रदूषण के कुप्रभावों की पहचान कराना	वायु प्रदूषण के कुप्रभावों तथा स्वास्थ्य के लिए शुद्ध वायु की आवश्यकता सम्बन्धी छात्रों के अनुभवों का स्मरण कराइए और पूछिए: धुएं से भरे वातावरण में कुछ समय तक रहने के पश्चात तुम कैसा अनुभव करते हो? (घुटन की अनुभूति होती है तथा आंखों में पानी आ जाता है) क्या होता है जब तुम मृत और सड़े-गले पदार्थों के समीप खड़े होते हो? (उल्टी महसूस होती है) तुम ऐसा अनुभव क्यों करते हो? (दुर्गन्ध के कारण) सड़े मृत-पशुओं और पौधों की दुर्गन्ध का वायु पर क्या प्रभाव पड़ता है? (वायु प्रदूषित हो जाती है) स्वास्थ्य को अच्छा बनाए रखने के लिए किस प्रकार की वायु आवश्यक है? छात्रों को अवगत कराइए कि अच्छे स्वास्थ्य के लिए शुद्ध वायु आवश्यक है। प्रदूषित वायु स्वास्थ्य के लिए हानिकारक है।	
अच्छे स्वास्थ्य के लिए शुद्ध वायु की आवश्यकता का बोध कराना	वायु प्रदूषण का पौधों और पैदावार पर क्या प्रभाव पड़ता है? (पौधे और फसल क्षतिग्रस्त हो जाते हैं) **विस्तारण 1** वायु प्रदूषण के अन्य प्रभाव क्या हैं? कुछ वर्ष पूर्व भोपाल में घटित उस घटना का स्मरण दिलाइए और उससे सम्बन्धित विस्तृत विवरण की विवेचना कीजिए जिसमें 'कार्बाइड गैस प्लान्ट' से विषैली गैस के रिसाव के कारण वायु इस सीमा तक प्रदूषित हो गई कि हजारों पुरुषों, स्त्रियों और बच्चों को अपना जीवन खोना पड़ा। आज भी उससे पीड़ित व्यक्ति नेत्र रोग का कष्ट भोग रहे हैं। उक्त दुःखद घटना के परिणाम स्वरूप विकृत शिशुओं ने जन्म लिया है।	

छात्रों को इस तथ्य से अवगत कराएं कि निर्जीव वस्तुएं भी प्रदूषण के प्रभाव से अछूती नहीं हैं। कुछ ऐतिहासिक इमारतों और स्मारकों के दृष्टान्त कीजिए जो प्रदूषण को बढ़ावा देने वाली बढ़ती हुई औद्योगिक सक्रियता के कारण क्षरण और विकृति का सामना कर रही हैं।

विस्तारण 2

तुम प्रदूषित वायु से अपनी रक्षा किन उपायों द्वारा करते हो?
छात्रों को इस बात से अवगत कराइए कि घरों में उचित वायु संचार से शुद्ध वायु की गति-विधि में सुविधा होती है। खिड़कियां खुली रखने पर शुद्ध वायु प्राप्त होती है। इस प्रकार प्रदूषित वायु का प्रभाव कम हो जाता है। स्पष्ट कीजिए कि बन्द कमरे में जलती अंगीठी नहीं रखना चाहिए क्योंकि इससे वायु बहुत अधिक प्रदूषित हो जाती है।

इकाई 5: बल, कार्य तथा ऊर्जा

(बल, कार्य और ऊर्जा, सरल यंत्र)

प्रस्तावना

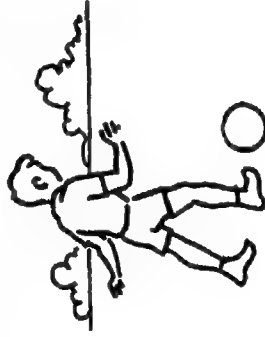
छात्र, बल तथा ऊर्जा के बारे में, कक्षा 4 में जान चुके हैं। वे ऊर्जा के विभिन्न स्त्रोतों से भी परिचित हैं। वे यह भी जानते हैं कि ऊर्जा का रूपान्तरण एक रूप से दूसरे रूप में किस प्रकार किया जा सकता है।

— विभिन्न वस्तुओं पर बल के प्रभाव से परिचित होने,
— बल लगाने की विभिन्न विधियों तथा कार्य करने में उनके महत्व को बताने,
— दैनिक जीवन में कार्य करने के लिए विभिन्न प्रकार के सरल यंत्रों से परिचित होने,
— ऊर्जा संरक्षण के कारणों तथा ऊर्जा के समुचित उपयोग के उपायों से अवगत होने में, समर्थ होंगे।

5.1: विभिन्न वस्तुओं पर बल लगाने के प्रभाव क्या हैं?
केंन्द्रित करें: बल लगाने से गति उत्पन्न होती है।

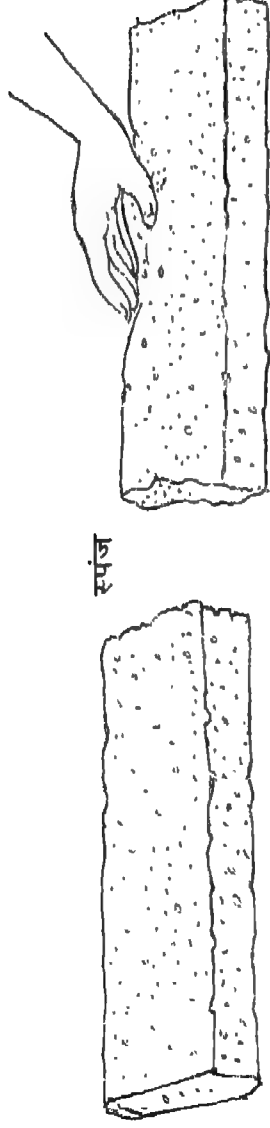
(कालांश 1-2

अधिगम परिणाम	प्रस्तावित शिक्षण प्रक्रम	साधन एवं सामग्री
	क्रियाकलाप 1	
विभिन्न वस्तुओं पर बल लगाने के प्रभाव से परिचित कराना	किसी छात्र से कहिए कि मेज, डस्टर तथा डोरी से बंधे पत्थर को खींचे अथवा धकेले। मेज, डस्टर अथवा पत्थर पर क्या प्रभाव होता है? निष्कर्ष निकालिये कि धकेल अथवा खिचाव, स्थिर वस्तुओं को गतिमान बना देता है। किसी एक छात्र से कहिए कि मेज को खीचें तथा दूसरे छात्र से कहिए कि उसी दिशा में धक्का दें।	मेज, डस्टर, पत्थर, धागा
गतिमान वस्तु पर बल लगाने के प्रभाव से परिचित कराना	तुम क्या देखते हों? यह अधिक तेज क्यों चलने लगती है?	
	क्रियाकलाप 2	
	दो छात्रों से कुछ दूरी पर आमने-सामने खड़े रहने को कहिए। एक छात्र से कहिए कि फर्श/जमीन पर	

बल गतिमान वस्तु को धीमी कर सकता है अथवा इसकी दिशा को बदल सकता है, इस बात का बोध कराना	दूसरे लड़के की ओर फुटबाल लुढ़काए तथा दूसरे छात्र से कहिए कि लुढ़कते फुटबाल के विपरीत दिशा में बल लगाए। गतिमान फुटबाल पर अन्य किसी दिशा में ठोकर मारने को भी कहिए। उनसे पूछिए: क्या होता है जब लुढ़कती हुई गेंद के विपरीत दिशा में बल लगाया जाता है? क्या ठोकर मारने के पश्चात भी फुटबाल अपनी गति की दिशा में ही गतिमान रहती है? फुटबाल की गति की दिशा में परिवर्तन क्यों हुआ? अगरबत्ती से निकलते हुए धुआं पर धीरे से हवा फूकने पर, इसके गति की दिशा क्यों बदल जाती है? यह निष्कर्ष निकालने में छात्रों की सहायता कीजिए कि बल गतिमान वस्तु की गति धीमी कर सकता है अथवा उसकी दिशा को बदल सकता है।	फुटबाल

5.2: मुलायम वस्तुओं पर बल लगाने का क्या प्रभाव होता है?
केन्द्रित करें: बल, मुलायम वस्तुओं को विकृत कर सकता है।

(कालांश 1-2)

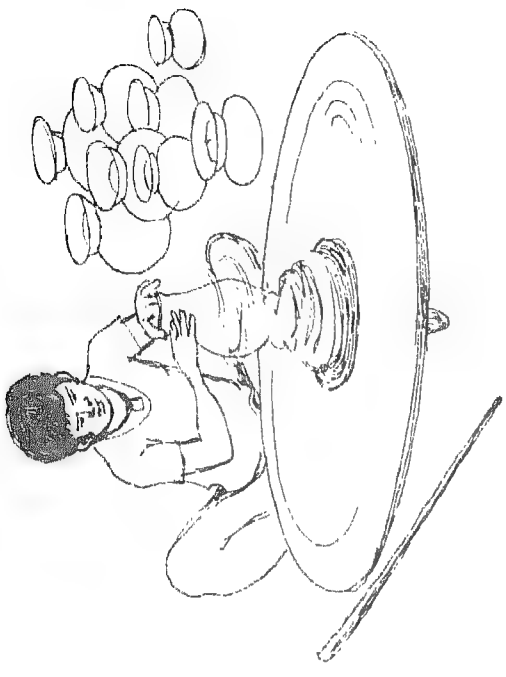
अधिगम परिणाम	प्रस्तावित शिक्षण प्रक्रम	साधन एवं सामग्री
	क्रियाकलाप 1	
मुलायम (कोमल) वस्तुओं पर बल लगाने के प्रभाव से परिचित कराना	गेंद के रूप में गुंधा हुआ आटा, चिकनी मिट्टी अथवा प्लास्टिसीन, छात्रों को दीजिए तथा उनसे कहिए कि उसे दबाएं।	गुंधा आटा, चिकनी मिट्टी, प्लास्टिसीन, गुब्बारा

उनसे पूछिए:
क्या होता है जब गुंधें हुए आटे, चिकनी मिट्टी या प्लास्टिसीन की गेंद को दबाया जाता है?
मुलायम वस्तुएं क्यों विकृत हो जाती है?
(मुलायम वस्तुओं पर लगाया गया बल उसे विकृत कर देता है)

बल मुलायम वस्तुओं को विकृत कर सकता है

क्रियाकलाप 2

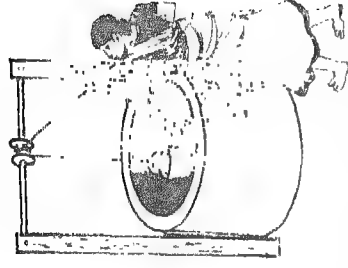
गुब्बारा, रूई, स्पन्ज

किसी एक छात्र को बड़ा गुब्बारा दीजिए तथा इसे थोड़ा-सा फुलाने को कहिए और तब इसे हाथ द्वारा दबाने को कहिए।
क्या होता है जब गुब्बारे को दबाया जाता है?
भीगी हुई स्पन्ज, रबर तथा कुछ अन्य वस्तुओं के उदाहरण बताइए।
छात्रों को स्पष्ट अनुभव कराइए कि बल लगाने से कुछ वस्तुएं विकृत हो जाती हैं।

छात्रों से कहिए कि दैनिक जीवन के वे उदाहरण दें जिनमें मुलायम वस्तुओं पर लगाए गए बल का उपयोग मनुष्य अपने लाभ के लिए करता है।
(टूथ पेस्ट ट्यूब को दबाने में, चपाती बनाने में, आलू को मसलने (कुचलने) में, आदि)

5.3: बल लगाने की विभिन्न विधियां क्या हैं?

केंन्द्रित करें: पेशीय बल एवं संचित ऊर्जा

(कालांश 1-2)

अधिगम परिणाम	प्रस्तावित शिक्षण प्रक्रम	साधन एवं सामग्री
	क्रियाकलाप 1	
पेशीय बल, वस्तुओं को खींचने तथा धकेलने में सहायता करता है, इस तथ्य से अवगत कराना	छात्रों का ध्यान दैनिक जीवन के अनुभवों की ओर विचार विमर्श द्वारा आकर्षित कीजिए जहां वस्तुओं पर बल विभिन्न प्रकार से लगाया जाता है। निम्नलिखित उदाहरणों में तुम किस प्रकार का बल लगाते हो जब: — झूले पर बच्चा बैठाकर, झूले को धक्का देते हो, — तुम रस्सा कसी का खेल खेलते हो, — तुम कुएं से पानी निकालते हो, — पशु गाड़ी को खींचते हैं। यह निष्कर्ष निकालने में उनकी सहायता कीजिए कि इन सभी उदाहरणों में पेशीय बल लगता है।	झूला, बाल्टी, रस्सी,गेंद

कुंए से पानी निकालती हुई औरत

क्रियाकलाप 2

संचित ऊर्जा मुक्त होने पर बल आरोपित करती है, इस तथ्य से परिचित कराना

किसी एक छात्र को एक इस प्रकार का खिलौना दीजिए जिसमें घुमावदार या पेंचदार युक्ति हो, यदि सम्भव हो तो उन्हें उस घुमावदार स्प्रिंग को दिखा दीजिए। छात्र से कुंजी द्वारा खिलौने की स्प्रिंग को कसकर इसे मुक्त करने को कहिए।

स्प्रिंगदार खिलोना रबर बैंड

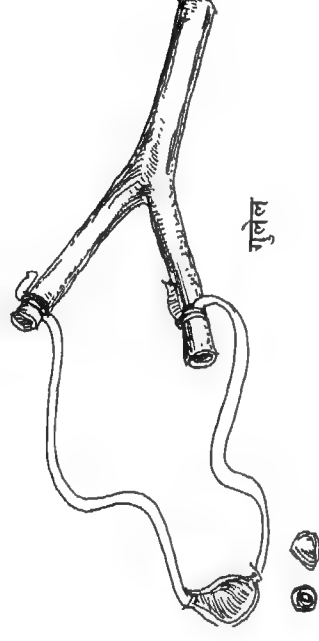
पूछिए:
तुम स्प्रिंग को क्यों घुमाते हो?
जब स्प्रिंग को मुक्त कर दिया जाता है तो क्या होता है?
(खिलौना आगे बढता है)

ऐसा क्यों हुआ?
यह निष्कर्ष निकालने में उनकी सहायता कीजिए कि स्प्रिंग में स्प्रिंग के अधिक कसे होने के कारण कुछ ऊर्जा संचित हो जाती है जो बल अरोपित करने में सहायक होती है। जब इसे मुक्त किया जाता है तो यह आगे बढ़ती है।

छात्रों से कहिए कि इस क्रियाकलाप की तुलना, रबरबैंड के तानने तथा इसे मुक्त कर देने की क्रिया से करें।

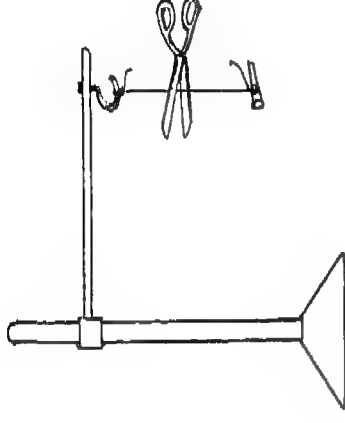
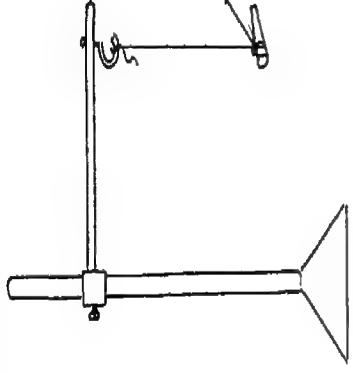
विस्तारण 1

गुलेल की क्रिया विधि समझने में छात्रों की सहायता कीजिए जिसमें रबर को पीछे खींच कर पत्थर के टुकड़े को दूर फेकने में संचित ऊर्जा का उपयोग किया जाता है।

गुलेल

5.4: गुरूत्व बल किस प्रकार आरोपित होता है?
केंद्रित करें: गुरूत्व बल

(कालांश 1-2)

अधिगम परिणाम	प्रस्तावित शिक्षण प्रक्रम	साधन एवं सामग्री
	क्रियाकलाप 1	
सभी वस्तुएं गिराए जाने पर गुरूत्व बल के कारण पृथ्वी पर गिरती हैं, इस तथ्य से अवगत कराना	किसी एक छात्र से कहिए कि अपने हाथ से पत्थर का टुकड़ा गिराए। तुम क्या निरीक्षण करते हो? पत्थर का टुकड़ा कहां गिरा?	पत्थर का टुकड़ा
	क्रियाकलाप 2	
	किसी दूसरे छात्र से कहिए कि चाक के टुकड़े को डोरी से बांधे, डोरी का एक सिरा हाथ से पकड़े रहें और डोरी को काटे।	चाक का टुकड़ा, डोरी, स्टैंड

तुम क्या देखते हो?
चाक का टुकड़ा कहां गिरा?

यह निष्कर्ष निकालने में छात्रों की सहायता कीजिए कि दोनों दशाओं में पत्थर तथा चाक का टुकड़ा नीचे पृथ्वी पर गिरा, मानों कोई उन्हें पृथ्वी की ओर खींच रहा है। पृथ्वी द्वारा लगाए गए इस खिंचाव (बल) को 'गुरूत्व बल' कहते हैं।

दैनिक जीवन की परिस्थितियों के आधार पर निम्नलिखित प्रश्न पूछिए:

सूखी पत्तियां पृथ्वी पर ही क्यों गिरती हैं?

वर्षा की बूदें पृथ्वी पर क्यों गिरती हैं?

यह निष्कर्ष निकालने में छात्रों की सहायता कीजिए कि पृथ्वी द्वारा वस्तुओं पर लगाया गया बल गुरूत्व बल कहलाता है। वस्तुओं द्वारा एक दूसरे पर लगाया गया बल गुरूत्वाकर्षण बल कहलाता है।

विस्तारण 1

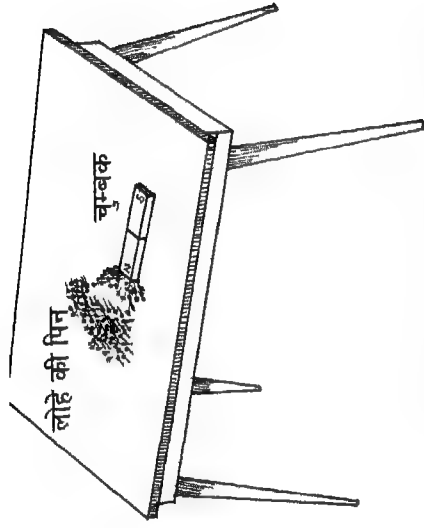
महान वैज्ञानिक न्यूटन जिसने गुरूत्वाकर्षण नियम की खोज की थी उससे सम्बन्धित कहानी का वर्णन कीजिए।

कहानी

एक दिन न्यूटन बाग में पेड़ के नीचे बैठा हुआ था। उस ने पेड़ से नीचे सेब गिरते हुए देखा। उसके मस्तिष्क में एक विचार उत्पन्न हुआ कि सेब ऊपर न जाकर पृथ्वी पर ही क्यों गिरा, इसके पीछे कोई कारण अवश्य है। अतः उसने निष्कर्ष निकाला कि पृथ्वी द्वारा एक बल लगता है जो सभी वस्तुओं को अपनी ओर आकर्षित कर लेता है, उसने इस बल को "गुरूत्व-बल" कहा।

5.5: चुम्बक द्वारा बल किस प्रकार लगाया जाता है?
केंन्द्रित करें: चुम्बकीय बल

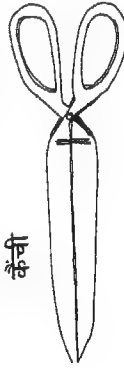
(कालांश 1)

अधिगम परिणाम	प्रस्तावित शिक्षण प्रक्रम	साधन एवं सामग्री
	क्रियाकलाप 1	
चुम्बकीय बल से परिचित कराना	किसी एक छात्र से कहिए कि मेज पर कुछ लोहे की कीलों, पिनों को फैलाए और उनके निकट एक चुम्बक लाए। तुम क्या देखते हो? (चुम्बक उन्हें अपनी ओर आकर्षित करता है) लोहे की पिनें/कीलें, चुम्बक से क्यों चिपक जाती हैं? (चुम्बक लोहे को आकर्षित करता है अतः लोहे की कीलें/पिनें चुम्बक से चिपक जाती है)' उन्हें समझाइए कि चुम्बक द्वारा लगाये गये बल को "चुम्बकीय बल" कहते हैं	लोहे की कीलें पिन, चुम्बक

चुम्बक लोहे की वस्तुओं को आकर्षित करता है

5.6: सरल यन्त्रों द्वारा कार्य को कैसे आसान बनाया जा सकता है?

केंन्द्रित करें: सरल यंत्र कार्य को आसान बना देते हैं।

(कालांश 2-3)

अधिगम परिणाम	प्रस्तावित शिक्षण प्रक्रम	साधन एवं सामग्री
	क्रियाकलाप 1	
दैनिक जीवन में उपयोग में आने वाले विभिन्न प्रकार के यंत्रों से परिचित कराना	छात्रों का ध्यान उन विभिन्न सरल यंत्रों मशीनों की ओर विचार विमर्श द्वारा आकर्षित कीजिए जिन्हें वे कार्य को सरल करने के लिए दैनिक जीवन में उपयोग में लाते हैं।	चाकू, ब्लेड, कैंची

सब्जी काटने के लिए उपयोग में आने वाले औजारों के नाम बताइए।
कपड़ा काटने के लिए प्रयुक्त औजार का नाम बताइए।
पेंसिल बनाने के लिए प्रयोग में आने वाले औजार का नाम बताइए।
लकड़ी काटने के लिए उपयोग में आने वाली वस्तु का नाम बताइए।
जलते हुए कोयले के टुकड़े को उठाने के लिए कौन सी वस्तु उपयोग में लाते हो?

क्रियाकलाप 2

इस तथ्य से अवगत कराना कि सरल यंत्रों से कार्य सरल हो जाता है

सेब, आलू, चाकू

दो छात्रों को बुलाइए और उनसे सेब/आलू को चार बराबर भागों में काटने के लिए कहिए। एक छात्र से चाकू की सहायता से तथा दूसरे छात्र से बिना चाकू की मदद से इसे काटने को कहिए।
सेब/आलू को चार बराबर भागों में काटने में कौन सक्षम है?

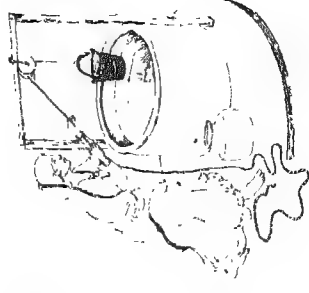
(चाकू की सहायता से काटने वाला छात्र)
सेब/आलू को काटने में वह क्यों सक्षम है?
(वह सेब/आलू को काटने में इसलिए सक्षम है क्योंकि वह चाकू का उपयोग कर रहा है)
छात्र से सेब/आलू को लकड़ी अथवा प्लास्टिक के स्केल से काटने को कहिए।
चाकू अथवा स्केल में से कौन सेब को आसानी से और जल्दी काटने में सक्षम है?

क्रियाकलाप 3

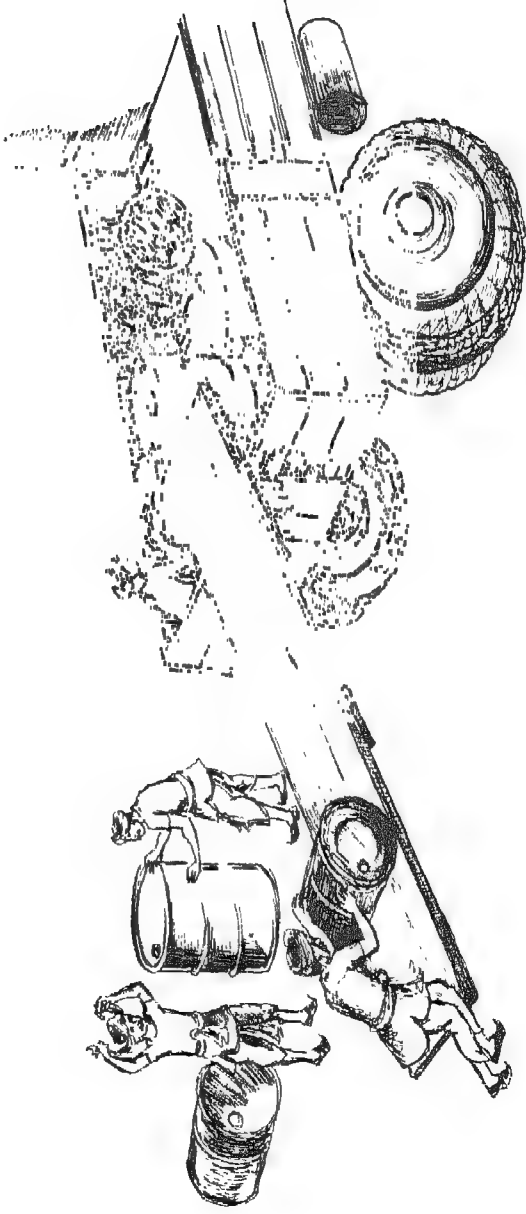
छात्रों का ध्यान उनके दैनिक जीवन के अनुभवों की ओर आकर्षित कीजिए।
छात्रों ने कूएं से सीधे रस्सी की सहायता से तथा घिरनीसे गुजरने वाली रस्सी द्वारा पानी निकालते देखा होगा।
पानी निकालने के लिए कौन-सी विधि अधिक आसान है?
जब रस्सी घिरनी से होकर गुजरती है, तब कुंए से पानी निकालना क्यों आसान हो जाता है?
(घिरनी के प्रयोग से कुएं से पानी का निकालना आसान हो जाता है
यह निष्कर्ष निकालने में छात्रों की सहायता कीजिए कि चाकू और घिरनी जैसी वस्तुओं को जिनसे हमारा कार्य आसानी से और जल्दी हो जाता है, सरल यंत्र कहते हैं।

क्रियाकलाप 4

छात्रों को दैनिक जीवन से सम्बन्धित परिस्थितियों के चित्र दिखाइए जहां औजारों और सरल यन्त्रों का उपयोग होता है।

दैनिक जीवन में उपयोग में आने वाले सरल यंत्रों के चित्र

उनसे पूछिए:
जब भारी वस्तुओं को लारी, ट्रक या गाड़ी पर लादा या उतारा जाता है तो किस प्रकार कार्य करने में आधिक आसानी होती है?

(क) वस्तुओं को सीधे उतारने में, अथवा
(ख) झुकी हुई स्थिति में लकड़ी के तख्ते पर वस्तु को रखकर खिसकाने अथवा लुढ़काने में। (झुके तख्ते पर लुढ़काने में)

उन्हें बताइए कि इस प्रकार काम में लाए गए तख्ते को एक झुका तल कहते हैं जो भारी वस्तु को उठाने में सहायक होता है।

यह निष्कर्ष निकालने में छात्रों की सहायता कीजिए कि सरल यंत्रों से हमारा कार्य आसान हो जाता है और जल्दी होता है। सरल यंत्रों की सहायता से (झुका हुआ तख्ता, चाकू) से हम कम बल का प्रयोग करके अधिक कार्य कर सकते हैं। यंत्र (घिरनी) द्वारा, कार्य करना सुविधाजनक बनाने के लिए बल प्रयोग की दिशा को बदला जा सकता है।

विस्तारण 1

छात्रों से कहिए कि उन सभी क्रियाकलापों की सूची तैयार करें जिन्हें वे अपने घर में या पास-पड़ोस में देखते हैं, जहां पर वे केवल अपने हाथों द्वारा कार्य करते हैं या जहां कार्य कुछ युक्तियों की सहायता से किया जाता है।

क्रियाकलाप	केवल हाथों द्वारा किया गया कार्य	अन्य युक्तियों द्वारा किया गया कार्य
तरकारी काटना	----	चाकू

5.7: उत्तोलक क्या है?

केंन्द्रित करें: उत्तोलक सरल यंत्र के रूप में

(कालांश 1-2)

अधिगम परिणाम	प्रस्तावित शिक्षण प्रक्रम	साधन एवं सामग्री
	क्रियाकलाप 1	
उत्तोलक का सरल यन्त्र के रूप में पहचान कराना	किसी एक छात्र से कहिए कि ढक्कनसहित टिन का डिब्बा लें। टिन के डिब्बे के ढक्कन को कस कर बंद कर दीजिए और तब छात्र से कहिए कि पहले अपनी अंगुलियों की सहायता से ढक्कन को खोले फिर एक चम्मच/पेचकस की सहायता से उक्त कार्य करें। ढक्कन का निकालना किससे आसान है? तुम क्या अंतर अनुभव करते हो? चम्मच से ढक्कन निकालना क्यों आसान है?	ढक्कन सहित टिन का डिब्बा, धातु का चम्मच/ पेचकस

यह निष्कर्ष निकालने में छात्रों की सहायता कीजिए कि चम्मच जो हमारा कार्य आसान कर देता है उत्तोलक की भांति कार्य करता है।

क्रियाकलाप 2

खुरपी, बेलचा

दो छात्रों से कहिए कि जमीन में छोटा गड्ढा खोदे।
एक छात्र से कहिए कि खुरपी से गड्ढा खोदें तथा दूसरे से छात्र से कहिए कि वह अपने हाथों द्वारा गड्ढा खोदे।
कौन-सा छात्र गड्ढे को तेजी से खोदने में सक्षम हैं?
छात्र, जिसके पास खुरपी है, गडढ़े को जल्दी से क्यों खोदता है?
(क्योंकि वह खुरपी का प्रयोग कर रहा है जो कि एक सरल यंत्र के समान कार्य करती है)

क्रियाकलाप 3

पत्थर, भारी पत्थर, लकड़ी की डंडी छड

किसी छात्र से कहिए कि भारी पत्थर को केवल अपने हाथों से उठाएं। पुनः उसी छात्र से कहिए कि उस भारी पत्थर के नीचे छेड़ लगाकर उठाए।

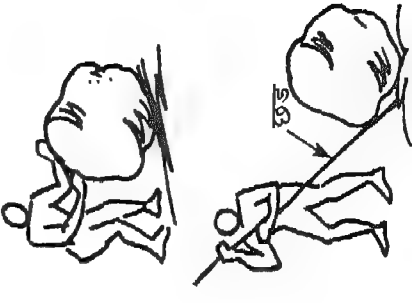
पूछिए:
तुम बिना अधिक प्रयास के पत्थर को उठाने के कब सक्षम हुए थे?
तुम छड़ की सहायता से पत्थर को सरलता से उठाने में क्यों सफल हुए?
(क्योंकि छड़ एक सरल यंत्र के रूप में कार्य करती है)

क्रियाकलाप 4

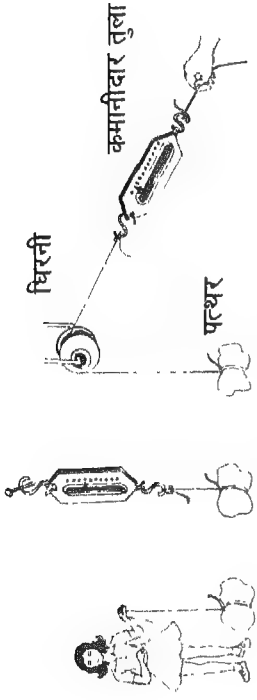
पेंचकस, चिमटा, कैंची, छोटी चिमटी

छात्रों से कहिए कि एक बहुत छोटी वस्तु को उठाएं जिसे वे सरलता से हाथों द्वारा नहीं उठा सकते हैं। उन्हें कई औजार चिमटा, पेंचकस, कैंची या छोटी चिमटी दीजिए।

इनमें कौन-सा औजार इस छोटी वस्तु को आसानी से उठाने के लिए उपयोग में लाया जा सकता है?

यह निष्कर्ष निकालने में छात्रों की सहायता कीजिए कि छोटी चिमटी, जो एक उत्तोलक की तरह कार्य करती है, एक सरल यंत्र है। यह भी बताइए कि उपर्युक्त सभी औजार भी जो उत्तोलक की भांति कार्य करते हैं, सरल यंत्र हैं।

5.8: घिरनियां क्या हैं?
केंन्द्रित करें: घिरनियां सरल यंत्र के रूप में

(कालांश 1-2)

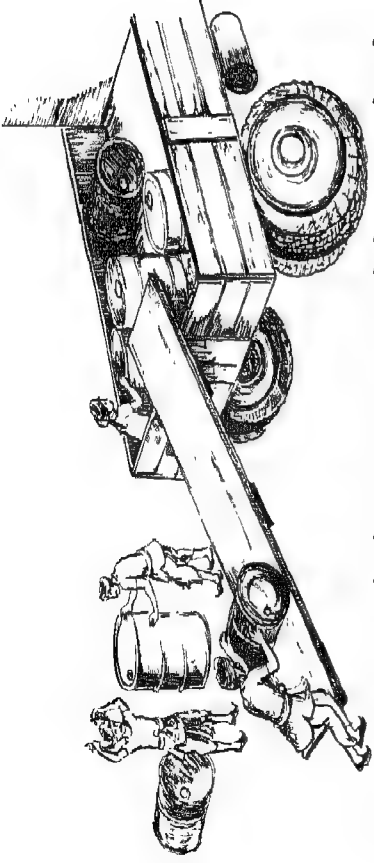
अधिगम परिणाम	प्रस्तावित शिक्षण प्रक्रम	साधन एवं सामग्री
	क्रियाकलाप 1	
यह पहचान कराना कि घिरनियां सरल यंत्र है	विचार विमर्श द्वारा छात्रों को पुनः स्मरण कराइये कि घिरनी से गुजरने वाली रस्सी से खींच कर कुंए से पानी निकालना अधिक आसान एवं सुविधाजनक है। छात्रों से कहिए कि ऐसे कार्यों के अन्य उदाहरण दें जिनमें कार्य को सरल करने के लिए घिरनी पर से गुजरती हुई रस्सी या डोरी का उपयोग होता है। डोरी की सहायता से एक पत्थर बांधिए। किसी एक छात्र/छात्रा से कहिए कि डोरी के स्वतंत्र सिरे को पकड़ कर उठाए। डोरी के स्वतंत्र सिरे को कमानीदार तुला में नीचे लगे हुक से बांधिए तथा इसके दूसरे सिरे पर लगे हुक को धीरे से हाथ से पकड़े रहिए जैसा कि चित्र में दिखाया गया है और इसका पाठ्यांक ज्ञात कीजिए। एक घिरनी को स्टैंड पर लगाकर उसके ऊपर से डोरी को गुजारिए जैसा कि चित्र में दिखाया गया है। पुनः इसे कमानीदार तुला की सहायता से पत्थर के टुकड़े को खींचिए और इसका पाठ्यांक ज्ञात कीजिए। उनसे पूछिए: इन दोनों दशाओं के पाठयांकों में क्या अंतर है? (पाठ्यांक में कोई अंतर नहीं है जो यह बताता है कि दोनों दशाओं में समान बल की आवश्यकता है) क्या पत्थर को घिरनी की सहायता से उठाना अधिक सुविधाजनक है? (घिरनी एक सरल यंत्र है जिसमें एक खांचेदार पहिया है। जब खांचे पर से डोरी/रस्सी को गुजारा जाता है तो यह भारी वस्तु को बल की दिशा बदलकर ऊपर उठाने में सहायक होती है)	कमानीदार तुला, डोरी, घिरनी, पत्थर का टुकडा

घिरनियां कार्य को सरल बनाती है

विस्तारण 1

भ्रमण (सैर) की व्यवस्था कीजिए और क्रेन आदि की सहायता से भारी बोझ को उठाते हुए घिरनी का उपयोग दिखाइए। ध्वज दण्ड, पर्दे या लिफ्ट आदि, घिरनी के उपयोग के अन्य उदाहरण हैं।

5.9: नत समतल, वस्तुओं को उठाने में कैसे सहायक है?
केंन्द्रित करें: नत समतल एक सरल यंत्र है

(कालांश 1)

अधिगम परिणाम	प्रस्तावित शिक्षण प्रक्रम	साधन एवं सामग्री
	क्रियाकलाप 1	
परिचित कराना कि नत समतल एक सरल यंत्र के रूप में कार्य करता है	श्यामपट्ट पर चित्र बनाकर छात्रों से पूछिए: क्या गाड़ी में बैरल को उठाकर रखना मनुष्य के लिए आसान होगा, अथवा ढालू लकड़ी के तख्ते पर से लुढ़काकर ले जाने से आसानी होगी? (नत समतल, वस्तुओं को ऊपर उठाने/लुढ़काने में सहायता करता है)	

झुका तल, भारी वस्तुओं को उठाकर ट्रक पर रखने में सहायक होता है

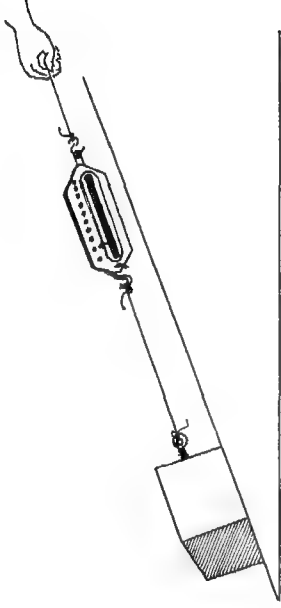
क्रियाकलाप 2

नत समतल लीजिए तथा चित्र की भांति क्रियाकलाप को व्यवस्थित कीजिए।

छात्रों से कहिए कि डोरी के एक सिरे को कमानीदार तुला से तथा दूसरे सिरे को लकड़ी के गुटके से बांधें।
लकड़ी के गुटके को लटकाकर कमानीदार तुला का पाठ्यांक पढ़वाइए।
लकड़ी के गुटके नत समतल पर रखिए और धीमे से इस प्रकार खींचिए कि यह चलने लगे और इसका पाठ्यांक पढ़िए।

नत समतल कमानीदार तुला, लकड़ी का गुटका, धागा, डोरी

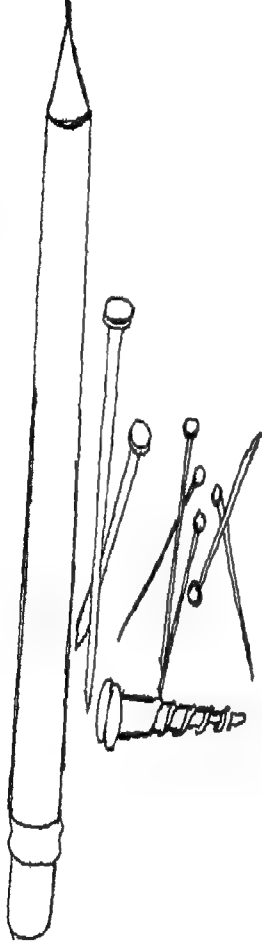
उनसे पूछिए:
दोनों दशाओं में कमानीदार तुला के पाठ्यांकों में क्या अंतर है?
किस दशा में कमानीदार तुला का पाठ्यांक कम है?
दूसरी दशा में पाठ्यांक क्यों कम है?
(दूसरी दशा में पाठ्यांक इसलिए कम है क्योंकि जब लकड़ी के गुटके को नत समतल पर खिसकाया जाता है तो कम बल की आवश्यकता होती है)
छात्रों से और उदाहरण बताने को कहिए जहां नत समतल प्रयोग में लाया जाता है।
(जीना, सीढ़ी, बच्चों का स्लाइड, मकान बनाने में लकड़ी के तख्ते का उपयोग, पहाड़ी क्षेत्रों पर सड़कें, ढाल, आदि)

यह निष्कर्ष निकालने में छात्रों की सहायता कीजिए कि नत समतल एक सरल यंत्र है जो भारी बोझ को कम बल लगाकर उठाने में सहायता करता है। एक ढाल भी नत समतल कहलाता है।

झुका तल कार्य को सरल बनाता है

5.10: सरल यंत्र के रूप में पच्चर किस प्रकार लाभदायक है?
केंन्द्रित करें: चाकू एक सरल यंत्र के रूप में

(कालांश 1-2)

अधिगम परिणाम	प्रस्तावित शिक्षण प्रक्रम	साधन एवं सामग्री
	क्रियाकलाप 1	
पच्चर को, सरल यंत्र के रूप में परिचित कराना	कुल्हाड़ी, चाकू, छेनी (रुखानी), की धार की ओर छात्रों का ध्यान आकर्षित कीजिए तथा उनसे पूछिए कि प्रत्येक औजार के दोनों ओर की धारों में क्या अंतर है? (एक ओर की धार दूसरी ओर की धार की अपेक्षा अधिक तेज है) किसी एक छात्र को चाकू दीजिए और उसे कहिए कि आलू को पहले चाकू के तेज धार से काटे, तत्पश्चात इसके कुन्दधार से काटे। चाकू की किस ओर से आलू काटना अधिक आसान था? (तेज धार की ओर से काटना अधिक आसान था) उन्हें समझाइए कि पच्चर एक सरल यंत्र है, जिसकी दो कोरें होती हैं, एक तेज होती है और दूसरी तेज	आलू, चाकू

नहीं होती है। चपटे (कुन्द) कोर पर बल लगाया जाता है तथा तेज धार वाली कोर को उस वस्तु पर रखा जाता है जिसे काटना होता है। इसी प्रकार पेंसिल की नोक, कील, आलपिन, पच्चर के कुछ उदाहरण हैं।

क्रियाकलाप 2

नेलकटर, (नख कतरनी) पेच, कीलें, हथौड़ा, बोतल खोलने वाला सरौता, चिमटी, ध्वज दण्ड, पेंसिल की नोक तथा कलम की निब आदि वस्तु की आकृति की ओर छात्रों का ध्यान आकर्षित कीजिए। छात्रों से कहिए कि उक्त यंत्रों को उत्तोलक, घिरनी नत समतल तथा पच्चर के रूप में पहचानने तथा सारणी में भरें।

नेल कटर की ब्लैड	उत्तोलक
पेच की चूड़ी	पच्चर/नत समतल
कील	पच्चर
हथौड़ा	उत्तोलक
बोतल खोलने वाला	उत्तोलक
सरौता	उत्तोलक
ध्वज दण्ड का शीर्ष	घिरनी
पेंसिल की नोंक	पच्चर
कलम की निब	पच्चर
चिमटी	उत्तोलक

5.11: क्या कार्य करने के लिए ऊर्जा की आवश्यकता होती है?
केंन्द्रित करें: ऊर्जा, कार्य करने की क्षमता के रूप में

(कालांश 1-2)

अधिगम परिणाम	प्रस्तावित शिक्षण प्रक्रम	साधन एवं सामग्री
ऊर्जा के संरक्षण हेतु कारणो से परिचित कराना तथा ऊर्जा के अनुचित उपयोगों को रोकने के उपाय बताना	क्रियाकलाप 1 उन विभिन्न क्रिया-कलापों की ओर छात्रों का ध्यान आकर्षित कीजिए जिन्हें वे प्रतिदिन करते हैं। उनसे पूछिए: तुम भोजन क्यों करते हो? लोग गाड़ियों में पैट्रोल/डीजल क्यों भरवाते हैं? क्या होता है जब विद्युत पंखे का स्विच खोल दिया जाता है? व्यायाम के बाद तुम थकान क्यों अनुभव करते हो? यह निष्कर्ष निकालने में उनकी सहायता कीजिए कि सभी क्रियाओं में ऊर्जा की आवश्यकता होती है, कार्य करने की क्षमता को ऊर्जा कहते है। यदि ऊर्जा नहीं है तो कार्य नहीं किया जा सकता है।	

5.12: क्या ऊर्जा के स्रोत सीमिति है?
केंन्द्रित करें: ऊर्जा के विभिन्न स्रोत

(कालांश 1)

अधिगम परिणाम	प्रस्तावित शिक्षण प्रक्रम	साधन एवं सामग्री
इस तथ्य से अवगत कराना कि ऊर्जा के स्रोत सीमित हैं	क्रियाकलाप 1 दैनिक जीवन में ऊर्जा प्रदान करने वाले विभिन्न स्रोतों की ओर छात्रों का ध्यान आकर्षित कीजिए। उनसे पूछिए: ऊर्जा के विभिन्न स्रोत क्या हैं? (कोयला, पेट्रोलियम, सूर्य, पानी, बायोगैस, आदि) ऊर्जा के कौन-कौन से स्रोत सदैव रहने वाले है? (सूर्य, बहती हुई हवा, बहता हुआ पानी)	

उन ऊर्जा स्रोतों के नाम बताइए जो कुछ समय पश्चात समाप्त हो जाएगें?
(कोयला, पेट्रोलियम)

क्रियाकलाप 2

ऊर्जा के महत्व से परिचित कराना

कोयला तथा पेट्रोलियम और इनके रिक्तीकरण की ओर छात्रों का ध्यान आकर्षित कीजिए।

छात्रों से पूछिए:
ऊर्जा को संरक्षित करना क्यों आवश्यक है?
यह निष्कर्ष निकालनें में उनकी सहायता कीजिए कि कुछ चीजों का, जो ऊर्जा के स्रोत हैं, वर्तमान दर से लगातार उपयोग करने से, जल्दी ही समाप्त हो जाएंगी।

छात्रो से पूछिए:
क्या होता है जब कलम की स्याही, पेंसिल की लिखिज, जलती हुई मोमबत्ती तथा किसी टंकी में भरे पानी का उपयोग निरन्तर किया जाता है?
(स्याही, पेंसिल की लिखिज, मोमबत्ती और पानी, उपयोग करने से समाप्त हो जाते हैं)
कोयला एवं पेट्रोलियम से इनका सम्बन्ध बताइए कि इसी प्रकार यदि इनका उपयोग निरन्तर होता रहे तो वे समाप्त हो जाएगें।

कोयला तथा पेट्रोलियम के अधिक उपयोगों की ओर छात्रों का ध्यान आकर्षित कीजिए।
(उष्मा तथा विद्युत का उत्पादन, दवाइयां, प्लास्टिक, रंजक, पीड़क-नाशी रसायन, उर्वरक रेशे आदि)

यह निष्कर्ष निकालने में उनकी सहायता कीजिए कि कुछ विशेष ऊर्जा के स्रोतों को लगातार उपयोग करने से वे जल्दी ही समाप्त हो जाएगें। अतः ऊर्जा के इन स्रोतों को बचाना एवं इन्हें सुरक्षित रखना तथा ऊर्जा के वैकल्पिक स्रोतों को उपयोग अपरिहार्य है।

5.13: ऊर्जा कैसे संरक्षित होती है?
केंन्द्रित करें: ऊर्जा का संरक्षण

(कालांश 1-2)

अधिगम परिणाम	प्रस्तावित शिक्षण प्रक्रम	साधन एवं सामग्री
ऊर्जा संरक्षण की विधियों से अवगत कराना	क्रियाकलाप 1 दैनिक जीवन की उन स्थितियों की ओर छात्रों का ध्यान आकर्षित कीजिए जहां ऊर्जा का समुचित उपयोग किया जाता है। जब कोयला/लकड़ी, ईंधन के रूप में प्रयुक्त किए जाते हैं तब क्या हम उसका पूर्ण रूप से उपयोग करते हैं? तेज धूप वाले दिनों में तुम अपने कमरे के पर्दों को गिरा देते हो और बल्ब (प्रकाश स्रोत) का स्विच खोल देते हो, क्या तुम सही कार्य कर रहे हो? छात्रों से कहिए कि ऐसे उदाहरण बताएं जहां ऊर्जा का समुचित उपयोग नहीं होता है। क्रियाकलाप 2 विचार विमर्श कीजिए और छात्रों से पूछिए कि ऊर्जा का समुचित उपयोग कैसे कर सकते हैं अर्थात् ऊर्जा को संरक्षित कैसे किया जा सकता है। उनसे पूछिए: विद्युत ऊर्जा को कैसे संरक्षित करेंगे? (विद्युत उपकरणों को बंद कर देना चाहिए जब उनका उपयोग न किया जा रहा हो) कोयला, मिट्टी का तेल तथा लकड़ी के अन्य विकल्प क्या हो सकते हैं? (कोयला, मिट्टी का तेल तथा लकड़ी के स्थान पर सौर-ऊर्जा या वायो-गैस का उपयोग भोजन पकाने में किया जाना चाहिए) खाना पकाते समय ऊष्मीय ऊर्जा की बचत के लिए तुम क्या सावधानियां बरतोगे? (खाना बनाते समय बर्तन ढक्कन से ढका होना चाहिए। साधारण बर्तनों के स्थान पर प्रेशर कूकर का उपयोग करना अधिक उचित होगा। बर्तनों की पैंदी काली कर देनी चाहिए। आग जलाने से पहले सब्जियों को काट लेना चाहिए। भोजन बनने पर परिवार के सभी सदस्यों को साथ बैठकर भोजन	

करना चाहिए, ताकि भोजन पुनः गर्म न करना पड़े)

विभिन्न यंत्रों अथवा गाड़ियों की उपयोग में लाने के लिए क्या सावधानियां लेनी चाहिए?

(जब सड़कों के चौहरों पर लाल बत्ती हो तब गाड़ियों के दाह-स्विच को बंद कर देना चाहिए। गाड़ियों की मशीनरी या फैक्टरी में मशीनों को चलाने के लिए स्नेहक (ग्रीस) का उपयोग किया जाना चाहिए। इस तथ्य की महत्ता से छात्रों को अवगत कराइए कि ऊर्जा का संरक्षण अत्यन्त आवश्यक है।

इकाई 6: पृथ्वी और आकाश (छाया)

प्रस्तावना

छात्र पारदर्शक और अपारदर्शक वस्तुओं के विषय में जानते हैं वे यह भी जानते हैं कि जब वे धूप में या रात में बल्व या ट्यूब लाइट की रोशनी में खड़े रहते हैं तो छाया बनती है। वे चन्दमा की कलाओं तथा प्राकृतिक व कृत्रिम उपग्रहों के विषय में भी जानते हैं।

इस इकाई द्वारा छात्र

- पारदर्शक पारभाषक तथा अपारदर्शक वस्तुओं में विभेद करने,
- जब प्रकाश किसी अपारदर्शक वस्तु द्वारा रोका जाता है तो उस वस्तु की छाया बनती है, जानने
- वस्तु के आकार और बनी छाया के बीच सम्बन्ध जानने,
- छाया के आकार और अपारदर्शक वस्तु की प्रकाश स्रोत से दूरी किस प्रकार सम्बन्धित है, जानने,
- छाया के बनने और ग्रहण के बीच सम्बन्ध स्थापित करने,
- सूर्य ग्रहण के कारणों की जानकारी प्राप्त करने,
- चन्द्र ग्रहण के कारणों की जानकारी प्राप्त करने,
- सूर्य ग्रहण और चन्द्र ग्रहण में विभेद करने,
- सूर्य ग्रहण, चन्द्र ग्रहण क्रमशः अमावस्या और पूर्णिमा को पड़ते है, जानने, में समर्थ होंगे।

6.1: पारदर्शक, पारभाषक और अपारदर्शक वस्तुएं क्या होती हैं?

केंन्द्रित करें: प्रकाश का संचरण और छाया का बनना (कालांश 2-3)

अधिगम परिणाम	प्रस्तावित शिक्षण प्रक्रम	साधन एवं सामग्री
	क्रियाकलाप 1	
पारदर्शक, पारभाषक व अपारदर्शक वस्तुओं का वर्गीकरण करना	छात्रों के पूर्व अनुभव के आधार पर स्मरण कराइए कि वे कौन-कौन सी वस्तुएं हैं जिनसे प्रकाश आरपार जा सकता है, और किन-किन वस्तुओं से प्रकाश आरपार नहीं जा सकता।	

उनसे पूछिए:
ऐसी कुछ वस्तुओं के नाम बताइएं, जिनसे प्रकाश आरपार जा सकता है?
ऐसी कुछ वस्तुओं के नाम बताएं, जिनसे प्रकाश आरपार नहीं जा सकता है?

क्रियाकलाप 2

मोमबत्ती, माचिस, पतंगी कागज, तेल लगा कागज, कांच की स्लाइड/प्लेट, लकड़ी का गुटका

एक मोमबत्ती जलाइए और एक छात्र को कांच की प्लेट, उसके सामने रखकर दूसरी ओर से देखने को कहिए और पूछिए:
तुम क्या देखते हो?
कांच की प्लेट की जगह पतंगी कागज (तेल लगा कागज) रखकर दूसरी ओर से मोमबत्ती की लौ देखने को कहिए।
अब तुम क्या देखते हो?
दोनों अवस्थाओं में मोमबत्ती की लौ में क्या अन्तर दिखाई पड़ता है?
उन्हें यह निष्कर्ष निकालने में सहायता कजिए कि कांच की प्लेट से मोमबत्ती की लौ स्पष्ट दिखाई देती है जब कि पतंगी कागज (तेल लगा कागज) रखने पर स्पष्ट दिखाई नहीं देती है।

उन्हें बताइए कि जिस पदार्थ से प्रकाश आरपार जा सकता है उसे पारदर्शक तथा जिस पदार्थ से प्रकाश कम मात्रा में आर पार जा सकता है उसे पारभाषक कहते हैं। छात्रों से कहिए कि जलती मोमबत्ती के सामने एक लकड़ी का गुटका रख कर दूसरी तरफ से उसे देखें।

उनसे पूछिए:
तुम क्या देखते हो?

उन्हें समझाइए कि लकड़ी के गुटके से मोमबत्ती की लौ दिखाई नहीं देती है। वस्तु के पदार्थ को, जिससे प्रकाश आरपार नहीं जा सकता है, अपारदर्शक, कहते हैं।

विस्तारण 1

अपने पास-पड़ोस की कुछ वस्तुओं को एकत्र कर उन्हें निम्नलिखित सारणी में भरिए।

वस्तु	पार दर्शक	पारभाषक	अपारदर्शक
कांच	✓	✗	✗
पंतगी कागज	✗	✓	✗
लकड़ी का गुटका	✗	✗	✓
नोट बुक का पृष्ठ			
घिसा कांच			
तेल लगा कागज			
प्याज का छिलका			

क्रियाकलाप 3

यह जानना कि जब प्रकाश अपारदर्शक वस्तुओं द्वारा अवरूद्ध होता है तो छाया बनती है

मोमबत्ती, माचिस, कांच की स्लाइड, पंतगी कागज, लकड़ी का गुटका

छात्रों को उनके पूर्व अवलोकन का स्मरण कराइए कि क्या जलती मोमबत्ती, कांच की स्लाइड, पतंगी कागज अथवा लकड़ी के गुटके के आरपार देखा जा सकता है। क्रियाकलाप 6.1.2 के संदर्भ में उनसे पूछिए कि क्या इन वस्तुओं में से किसी वस्तु की छाया दीवार पर बनती है।

पूछिए:
लौ के सामने कांच की स्लाइड/पत्तर रखने पर, तुम दीवार पर क्या देखते हो?
लौ के सामने, पंतगी कागज रखने पर तुम दीवार पर क्या देखते हो?
लौ और दीवार के बीच लकड़ी के गुटके को रखने पर तुम दीवार पर क्या देखते हो?
उपर्युक्त तीनों दशाओं में तुम्हें क्या अन्तर दिखाई देता है?

निष्कर्ष निकालने में उनकी सहायता कीजिए कि जब प्रकाश किसी वस्तु द्वारा अवरूद्ध होता है तो वस्तु की छाया बनती है। प्रकाश की उपस्थिति में, अपारदर्शक वस्तु की काली छाया बनती है, पारभाषक वस्तु की धुंधली छाया बनती है, और पारदर्शक वस्तु की कोई छाया नहीं बनती है। उन्हें बताइए कि पर्दे पर ही स्पष्ट छाया दिखाई देती है। पर्दे के रूप में दीवार, छत, जमीन, आदि हो सकती है। अपारदर्शक वस्तु, प्रकाश स्रोत और पर्दा तीनो छाया बनने के लिए आवश्यक है।

क्रियाकलाप 4

मोमबत्ती, टार्च, माचिस

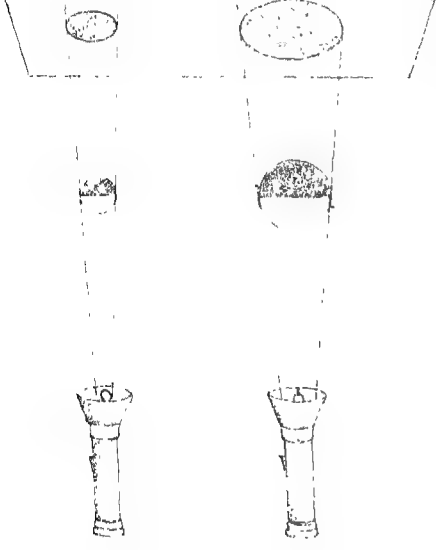
छात्रों से कहिए कि जलती हुई मोमबत्ती टार्च के सामने रखकर देखें।

क्या मोमबत्ती की लौ/ज्वाला की परछाई पर्दे पर दिखाई देती है?
(नहीं)
यह समझने में छात्रों की सहायता कीजिए कि छाया केवल अपारदर्शक वस्तुओं की ही बनती हैं यदि वस्तु स्वयं प्रकाशमान है तो उसकी छाया नहीं बनेगी।

टिप्पणी: जब पृथ्वी, चन्द्रमा और ग्रहों द्वारा सूर्य से आने वाला प्रकाश अवरूद्ध होता है, तब उनकी भी छाया बनती है।

6.2: छाया बनने में कौन से कारक प्रभावी होते हैं?
केंन्द्रित करें: छाया निर्माण को प्रभावित करने वाले कारक

(कालांश 1-2)

अधिगम परिणाम	प्रस्तावित शिक्षण प्रक्रम	साधन एवं सामग्री
	क्रियाकलाप 1	
छाया के आकार और वस्तु के आकार के बीच सम्बन्ध जानना	एक मोमबत्ती या टार्च जलाकर किसी छात्र से कहिए कि पहले एक छोटी गेंद उसके सामने रखकर, पर्दा/दीवार पर बनने वाली इसकी छाया को देखें। इसके पश्चात उसी दूरी पर एक बड़ी गेंद को जलती टार्च/मोमबत्ती के सामने रखकर पर्दा/दीवार पर बनने वाली उसकी छाया को देखें। उनसे पूछिए: कौन-सी छाया आकार में बड़ी है? कौन-सी छाया आकार में छोटी है? यह निष्कर्ष निकालने में छात्रों की सहायता कीजिए कि छाया का आकार वस्तु का आकार बढ़ने पर बढ़ जाता है।	मोमबत्ती, माचिस, टार्च, परदा या दीवार, बड़ी गेंद, छोटी गेंद

वस्तु का आकार बढ़ने के साथ छाया का आकार भी बढ़ता है।

क्रियाकलाप 2

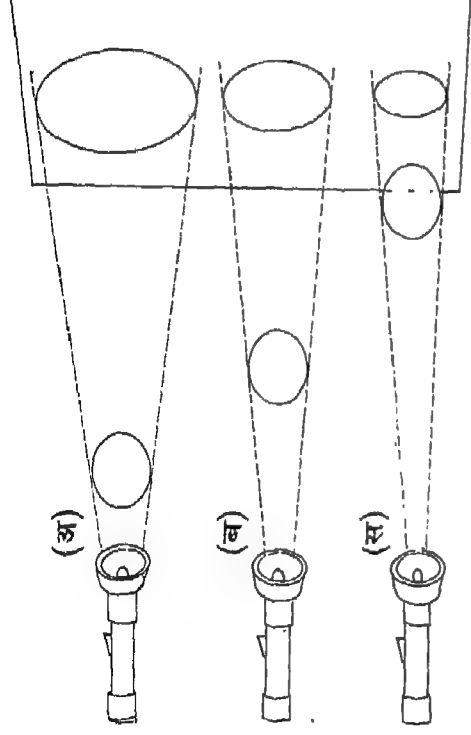
अपारदर्शक वस्तु की छाया और उसकी प्रकाश स्रोत से दूरी के बीच सम्बन्ध जानना

किसी छात्र से एक जलती मोमबत्ती/टार्च और दीवार/पर्दा के बीच एक गेंद रखने को कहिए

टार्च/मोमबत्ती, माचिस, छोटी गेंद, पर्दा

पूछिए:
तुम दीवार पर क्या देखते हो?
छाया क्यों बनती है?

छात्र से चित्र अ के अनुसार गेंद को प्रकाश स्रोत के समीप लाकर दीवार पर बनी इसकी छाया के आकार का अवलोकन करने को कहिए।

अब छात्र को चित्र ब और स के अनुसार गेंद को प्रकाश स्रोत से दूर ले जाकर इसकी छाया के आकार का अवलोकन करने के कहिए।
कौन सी छाया आकार में बड़ी है?
कौन सी छाया आकार में छोटी हैं?
(प्रकाश स्रोत से, बस्तु को दूर रखने पर, दीवार पर बनी इसकी छाया, आकार में छोटी हैं)

प्रकाश स्रोत से वस्तु की दूरी बढ़ने पर छाया का आकार घटता है

क्रियाकलाप 3

गेंद, मोमबत्ती/टार्च, माचिस

किसी छात्र से पूर्व क्रिया कलाप 6.2.2 के अनुसार गेंद को स्थिर जलती मोमबत्ती/टार्च को आगे पीछे सरका कर विभिन्न दूरीयों पर रखकर बनने वाली छाया का अवलोकन करने को कहिए जैसा कि चित्र अ, ब, स, में दिखाया गया है।

छात्रों से पूछिए:
कौन सी छाया सबसे अधिक काली और आकार में बड़ी है?
कौन सी छाया सबसे कम काली और आकार में छोटी है?

यह निष्कर्ष निकालने में छात्रों की सहायता कीजिए कि जब अपारदर्शक वस्तु प्रकाश स्रोत के पास होती है तो अधिक प्रकाश अवरूद्ध हो जाता है, अतः छाया आकार में अधिक बड़ी, स्पष्ट तथा काली होती है। जब प्रकाश स्रोत से वस्तु दूर होती है तो कम प्रकाश अवरूद्ध होता है और छाया आकार में छोटी, कम स्पष्ट तथा कम काली होती है।

टिप्पणी: छाया का बनना प्रकाश स्रोत के आकार और उसकी तीव्रता पर भी निर्भर करता है।

6.3: प्रातः काल से सांय काल तक सूर्य के प्रकाश से बनी छाया की लम्बाई किस प्रकार बदलती है?
केंन्द्रित करें: छाया, उसकी लम्बाई और दिशा

(कालांश 1-2)

अधिगम परिणाम	प्रस्तावित शिक्षण प्रक्रम	साधन एवं सामग्री
	क्रियाकलाप 1	
दिन में विभिन्न समय पर सूर्य के प्रकाश से बनी छाया की लम्बाई और दिशा में सम्बन्ध जानना	छात्रों से प्रातः खुले मैदान/खेत में एक लकड़ी की छड़ को सीधा (ऊर्ध्व) गाड़कर इसके छाया बनने के स्थान पर चिन्ह लगाने को कहिए। उनसे सूर्य के बनने वाली छाया की लम्बाई और दिशा भी नोट करने को कहिए।	लकड़ी की छड़, स्केल/फीता, ग्लोब घड़ी

क्या छाया उसी तरफ बनी है, जिधर सूर्य है?
उनसे दिन में प्रातः से सायं तक विभिन्न समयों पर उपर्युक्त क्रिया कलाप दोहराकर परिणाम को निम्नलिखित सारणी में भरने को कहिए।

समय	छाया की लम्बाई	छाया की दिशा
प्रातः 6 बजे		
प्रातः 9 बजे		
दोपहर 12 बजे		
अपरान्ह 3 बजे		
शाम 6 बजे		

किसी छात्र से कहिए कि ग्लोब के सतह पर माचिस की तीली को प्लास्टिसीन की सहायता से चिपका कर इसे धूप में रखते हुए उपर्युक्त क्रिया-कलाप को पुनः करें। — मॉचिस की तीली, प्लास्टिसीन, पृथ्वी चन्द्रमा मॉडल, मापक फीता

ग्लोब को धीरे-धीरे घुमा कर हर बार सूर्य के प्रकाश द्वारा ग्लोब पर बने माचिस की तीली की छाया की लम्बाई एवं दिशा को नोट करें।

उनके परिणामों की तुलना कीजिए और विचार विमर्श कीजिए।

उनसे पूछिए:
क्या छाया की लम्बाई, में कोई परिवर्तन है?
प्रातः काल की तुलना में दोपहर को अथवा सायंकाल छाया किस प्रकार है?

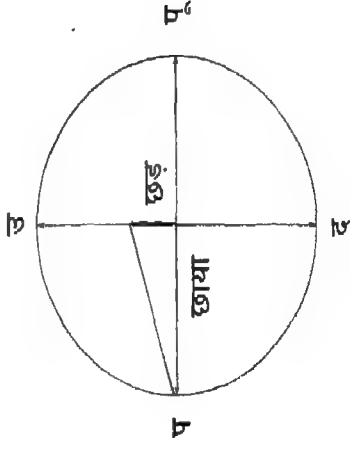
छाया की लम्बाई क्यों बदलती है?
यह निष्कर्ष निकालिए कि छाया की लम्बाई प्रातः से दोपहर तक घटती है।

दोपहर 12 बजे छाया सबसे छोटी होती है। इसके पश्चात दोपहर से शाम तक छाया की लम्बाई बढ़ती जाती है।

उन्हें बताइए कि छाया की लम्बाई और दिशा, पृथ्वी का अपने झुके अक्ष पर परिभ्रमण के कारण बदलती है।

विस्तारण 1

छात्रों से कहिए कि 30 से.मी. व्यास की गत्ते की वृत्ताकार चक्रिका लें और 10 से.मी. लम्बी एक छड़ उसके केन्द्र पर उर्ध्व स्थिति प्लास्टिसीन से चिपका दें। चक्रिका पर दिशाएं क्रमशः उ,द,पू,प, (उत्तर, दक्षिण, पूर्व, पश्चिम) अंकित करें उसे खुले स्थान पर रखकर बनने वाली छाया का एक-एक घण्टे के अन्तर पर निरीक्षण करें। समय के साथ बनने वाली छाया को चक्रिका पर अंकित करें।

गत्ता, छड़, कम्पास, (दिक्सूचक), घड़ी, फीता

सूर्य घड़ी का मॉडल

6.4: ग्रहण कैसे पड़ते हैं?
केंन्द्रित करें: सूर्य ग्रहण और चन्द्र ग्रहण में अन्तर

(कालांश 4-5)

अधिगम परिणाम	प्रस्तावित शिक्षण प्रक्रम	साधन एवं सामग्री
	क्रियाकलाप 1	
छाया बनने का ग्रहणों से सम्बन्ध जानना	छात्रों से कहिए कि पृथ्वी-चन्द्रमा के मॉडल को कमरे में जहां अधिक प्रकाश न हो, मेज पर व्यवस्थित करें। कल्पना करें कि ग्लोब/बड़ी गेंद (पृथ्वी) को और छोटी गेंद (चन्द्रमा को) प्रदर्शित करती हैं। अब टार्च/मोमबत्ती को जो सूर्य को प्रदर्शित करती है, प्रकाशित करें। एक छात्र से जलती टार्च/मोमबत्ती (सूर्य) को छोटी गेंद (चन्द्रमा) से, इसकी और ग्लोब (पृथ्वी) की सीध में कुछ दूरी पर पकड़े रहने को कहिए/छात्रों को चित्रानुसार पृथ्वी की सतह पर, चन्द्रमा की छाया का अवलोकन करने दीजिए। उनसे पछिए: तुम क्या देखते हो? (पृथ्वी की सतह पर चन्द्रमा की छाया) क्या होता है जब चन्द्रमा की छाया पृथ्वी पर पड़ती है? (पृथ्वी पर चन्द्रमा की छाया वाला भाग काला हो जाता है) पृथ्वी का एक भाग इस अवस्था में काला क्यों हो जाता है? (पृथ्वी पर पड़ने वाला सूर्य का प्रकाश, चन्द्रमा द्वारा अवरूद्ध हो जाता है) किसी आकाशीय पिण्ड द्वारा प्रकाश के अवरूद्ध होने की घटना को क्या कहते हैं? (ग्रहण) क्या पृथ्वी पर चन्द्रमा की छाया में स्थित कोई मनुष्य सूर्य के उस भाग को, जो चन्द्रमा द्वारा ढका हो, देख सकता है? (नहीं)	पृथ्वी-चन्द्रमा मॉडल, टार्च/मोमबत्ती
जानना कि सूर्य ग्रहण किस प्रकार पड़ता है।	सूर्य के प्रकाश को चन्द्रमा द्वारा अवरूद्ध करने की घटना को क्या कहते हैं? (सूर्य ग्रहण) सूर्य ग्रहण कैसे पड़ता है?	

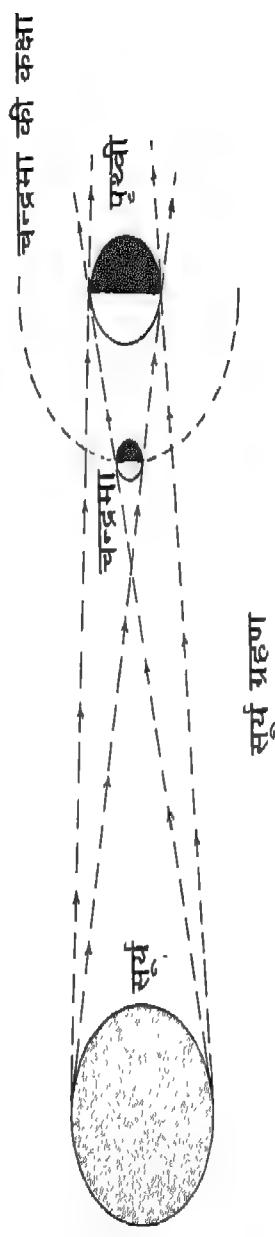
यह अनुभव करने में छात्रों की सहायता कीजिए कि जब, सूर्य चन्द्रमा और पृथ्वी एक ही सीधी रेखा में स्थित होते हैं और जब चन्द्रमा की छाया पृथ्वी पर पड़ती है, तब सूर्यग्रहण होता है, जैसा कि चित्र में दिखाया गया है।

पृथ्वी का वह भाग जो इस छाया में पड़ता है, वहां अंधेरा हो जाता है और सूर्य ग्रहण लग जाता है। उन्हें बताइए कि सूर्य ग्रहण केवल अमावस्या के दिन पड़ता है। जब सूर्य का कोई भाग आंशिक रूप से चन्द्रमा द्वारा ढका होता है तब हम सूर्य को केवल आंशिक रूप से देख सकते हैं। इसलिए इसे आंशिक सूर्य ग्रहण कहते हैं।

कभी-कभी ऐसा प्रतीत होता है कि सूर्य, चन्द्रमा द्वारा पूर्ण रूप से ढक गया है, इसे पूर्ण सूर्य ग्रहण कहते हैं।

चेतावनी

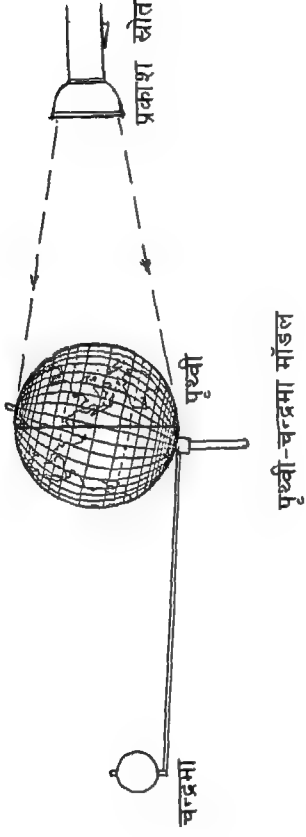
छात्रों को चेतावनी दीजिए कि वे सूर्य ग्रहण को नंगी आंखों से न देखें उनकी आंखें क्षतिग्रस्त हो सकती हैं।

सूर्य ग्रहण

क्रियाकलाप 2

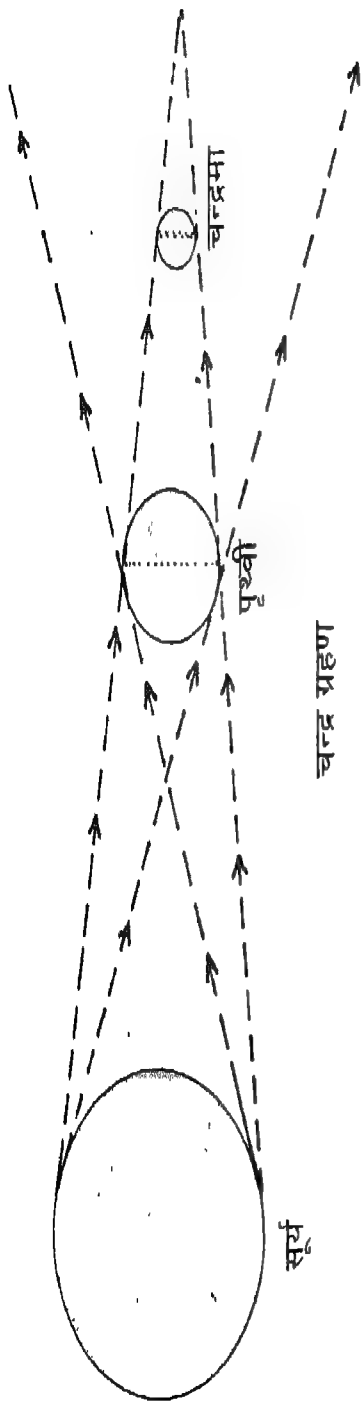
पहचानना कि चन्द्र ग्रहण कैसे घटित होता है

पृथ्वी चन्द्रमा मॉडल, टार्च/मोमबत्ती

छात्रों से कहिए कि क्रियाकलाप 6.4.1 में बड़ी गेंद (ग्लोब) तथा छोटी गेंद (चन्द्रमा) की स्थितियां पलट दें। छात्रों द्वारा छोटी गेंद (चन्द्रमा) को ग्लोब (पृथ्वी) के चारों और परिक्रमा कराए और जब चन्द्रमा, पृथ्वी की छाया में चित्रानुसार प्रवेश करे तो उसका अवलोकन करने दें।

पृथ्वी-चन्द्रमा मॉडल

पूछिए
तुम क्या देखते हो?
(पृथ्वी की छाया चन्द्रमा पर पड़ती है)
क्या होता है जब पृथ्वी की छाया चन्द्रमा पर पड़ती है?
(चन्द्रमा का वह भाग जो पृथ्वी की छाया में प्रवेश करता है वहां अंधेरा हो जाता है और चन्द्र ग्रहण लग जाता है)

चन्द्रग्रहण कैसे होता है?
यह जानने में छात्रों की सहायता कीजिए कि जब सूर्य, पृथ्वी और चन्द्रमा एक ही सीधी रेखा में होते हैं तब पृथ्वी की छाया चित्रानुसार चन्द्रमा पर पड़ती है और चन्द्रग्रहण लग जाता है।

उन्हें बताइए कि चन्द्रग्रहण केवल पूर्णिमा के दिन ही लगता है। यदि चन्द्रमा का आंशिक भाग ही पृथ्वी की छाया से ढका होता है तो हम इसे आंशिक चन्द्रग्रहण कहते हैं। जैसेही चन्द्रमा पृथ्वी के परितः गति करता है, वह कभी-कभी पृथ्वी की छाया में पूर्ण रूप से प्रवेश कर जाता है और पूर्ण चन्द्र ग्रहण घटित होता है।

चन्द्र ग्रहण

क्या होगा जब सूर्य, चन्द्रमा और पृथ्वी एक सीधी रेखा में स्थित नहीं होते हैं?
(ऐसी दशा में कोई ग्रहण नहीं होगा)
सूर्य ग्रहण, पूर्णिमा के दिन क्यों नहीं लगता है?
प्रत्येक अमावस्या को सूर्य ग्रहण क्यों नहीं लगता है?

प्रत्येक पूर्णिमा की रात्रि को चन्द्रग्रहण क्यों नहीं लगता है?
ग्रहण लगने के लिए क्या प्रतिबन्ध आवश्यक है?
यह अनुभव करने में छात्रों की सहायता कीजिए कि सूर्य, चन्द्रमा और पृथ्वी की सापेक्ष स्थितियां ग्रहण लगने के लिए बहुत महत्वपूर्ण हैं। उन्हें बताइए कि पृथ्वी के चारों ओर चन्द्रमा का परिक्रमण मार्ग समान नहीं है। यदि पूर्णिमा का दिन अथवा अमावस्या का दिन ऐसे दिन पड़ता है जब चन्द्रमा उस बिन्दु पर स्थित होता है जहां उपर्युक्त मार्ग एक दूसरे को काटते हैं, तभी सूर्य, चन्द्रमा और पृथ्वी एक सीधी रेखा में होते हैं और ग्रहण लगता है।

सूर्य ग्रहण और चन्द्र ग्रहण में अन्तर जानना

छात्रों को निम्न सारणी की पूर्ति करने को कहिये।

लक्षण	सूर्य ग्रहण	चन्द्र ग्रहण
चन्द्रमा की स्थिति		
पृथ्वी की स्थिति		
सूर्य ग्रहण/चन्द्र ग्रहण किस दिन पड़ता है		
ग्रहण जो लगते हैं		
(क) अमावस्या के दिन		
(ख) पूर्णिमा की रात्रि		

विस्तारण: 1

छात्रों से कहिए कि गत्ते की सहायता से सूर्य ग्रहण और चन्द्र ग्रहण के मॉडल बनाए। पीला चमकीला कागज सूर्य, हरा चमकीला कागज पृथ्वी, और सफेद चमकीला कागज चन्द्रमा के मॉडल के लिए प्रयोग करें। किरणों को दर्शाने के लिए पीले ऊन के धागों का उपयोग किया जा सकता है।

पीला, हरा और सफेद चमकील कागज, पीला ऊन

इकाई 7: पृथ्वी की प्राकृतिक सम्पदा

प्रस्तावना

पूर्व कक्षाओं में छात्रों को पृथ्वी की प्राकृतिक सम्पदा से परिचित कराया जा चुका है। भिन्न-भिन्न रूपों में इन संसाधनों के उपयोग के बारे में भी उन्होंने अध्ययन कर लिया है।

इस इकाई द्वारा छात्र:

— विविध प्राकृतिक संसाधनों को पहचानने और सूची बनाने,
— प्रकृति में अन्योन्याश्रय की सार्थकता को समझने,
— प्राकृतिक संसाधनों के उपयोगों को पहचानने,
— प्राकृतिक संसाधनों को संरक्षित करने की आवश्यकता के महत्व को समझने,
— नवीकरण योग्य और अनवीकरण योग्य प्राकृतिक सम्पदा, को पहचानने,
— प्रदूषण के कारणों को पहचानने एवं इसकी रोकथाम की विधियों को सूची बद्ध करने, में समर्थ होंगे।

7.1: पृथ्वी की सतह पर और भूमिगत प्राकृतिक संसाधन क्या हैं?

केंन्द्रित करें: प्राकृतिक सम्पदा

(कालांश 1-2)

अधिगम परिणाम	प्रस्तावित शिक्षण प्रक्रम	साधन एवं सामग्री
	क्रियाकलाप 1	
प्राकृतिक सम्पदा को पहचानना	कक्षा में और बाहर अपने आस-पास अवलोकन करने और जो वस्तुएं उपयोग में हैं, के नाम लिखने के लिए छात्रों से कहिए। उनसे पूछिए: हमारे जीवन के लिए क्या अत्यावश्यक है? (सूर्य का प्रकाश, वायु, जल और भोजन)	

हम जल और भोजन कहां से प्राप्त करते हैं?
(जल हम कुओं, नदियों, नलकूपों आदि से तथा भोजन पेड़-पौधों व जन्तुओं से प्राप्त करते हैं। उन्हें समझाइए कि वायु, जल, पेड़-पौधे व जन्तु बहुत पूर्व से ही मानव जाति के उपयोग में हैं और भविष्य में भी उपयोग में आते रहेंगे।

प्राकृतिक संसाधनों की सूची उनके प्राप्ति के स्थान के साथ, निम्नलिखित सारणी में, आपके संदर्भ हेतु दी जा रही है।

प्राकृतिक संसाधनों के नाम	भूमिगत/भू-तल पर
पेड़-पौधे	भूतल पर
जीव-जन्तु	भूतल पर
जल	भूमिगत/भूतल पर
वायु	भूतल पर
कोयला	भूमिगत
सूर्य का प्रकाश	भूतल पर
पैट्रोलियम	भूमिगत
खनिज	भूमिगत

समझाने का प्रयास कीजिए कि प्रकृति द्वारा जो पदार्थ उपलब्ध कराए जाते हैं वे प्राकृतिक संसाधन कहलाते हैं।

यह निष्कर्ष निकालने में उनकी सहायता कीजिए कि पृथ्वी पर कई प्राकृतिक संसाधन हैं। पौधे, जन्तु, सूर्य का प्रकाश, जल एवं वायु पृथ्वी की सतह पर उपलब्ध प्राकृतिक संसाधन हैं। कोयला, पैट्रोलियम और खनिज जैसे पदार्थ भूमिगत पाये जाते हैं।

7.2: विभिन्न प्राकृतिक संसाधनों को मानव कैसे उपयोग करते हैं?

केन्द्रित करें: विभिन्न प्राकृतिक संसाधनों के उपयोग

(कालांश 1-2)

अधिगम परिणाम	प्रस्तावित शिक्षण प्रक्रम	साधन एवं सामग्री
	क्रियाकलाप 1	
वायु, जल, वनस्पति और जन्तुओं को मनुष्य जिन उपायों द्वारा उपयोग करता है, उन्हें पहचानना	एक छात्र से कहिए कि जलचकरी ले और उसे मुंह से फूंककर चलाए। दूसरे छात्र से कहिए कि वह गहरी श्वास ले। पूछिए जलचकरी किसके द्वारा चल रही है? (वायु) श्वास में तुम क्या लेते हो? (वायु) छात्र ''क'' से कहिए कि हथपंखे से अपने मित्र ''ख'' के लिए पंखा करें। फिर छात्र ''ख'' से पूछिए: तुम कैसा अनुभव करते हो? (ठण्डा) क्यों? (चलती हुई वायु के कारण) पूर्व ज्ञान के आधार पर उस प्रक्रिया का स्मरण कराइए जिसके द्वारा पेड़-पौधे, भोजन निर्मित करते हैं। छात्रों को समझाने का प्रयास कीजिए कि वायु का उपयोग निम्नलिखित प्रकार से होता है: — मशीनों को चलाने में, — श्वास लेने में, — शीतलन में, — पेड-पौधों द्वारा भोजन निर्माण में।	जलचकरी
	क्रियाकलाप 2 जल को विभिन्न तरीकों से उपयोग करने के अनुभवों का छात्रों को स्मरण कराइए। उनसे पूछिए:	

जल के विभिन्न उपयोग क्या है?
(पीने में, सिंचाई में, सफाई में, शीतलन और ऊर्जा प्राप्त करने में)
दैनिक जीवन में पेड़-पौधों, जन्तुओं और उनके उत्पादों के उपयोग के बारे में छात्रों के अवलोकनों का स्मरण कराइये।

उनसे पूछिए:
हम पेड़-पौधों से क्या प्राप्त करते हैं?
(भोजन, आक्सीजन, ईंधन, लकड़ी, गोंद, मोम, रबड़, औषधियां, आश्रय, आदि। वे वर्षा के होने और मृदा अपरदन की रोकथाम करने में सहायता करते हैं)
हम जन्तुओं से क्या प्राप्त करते हैं?
(भोजन, चमड़ा, औषधियां, ऊन, ईंधन-गोबर, वसा/तेल, वायोगैस, कार्य आदि)
उन्हें समझाने का प्रयास कीजिए कि वायु, सूर्य का प्रकाश, जल, पेड़-पौधें और जन्तु जैसे प्राकृतिक संसाधन और उनके उत्पाद मानव के लिए अति उपयोगी हैं।

क्रियाकलाप 3

चट्टानों, खनिजों, कोयला और पैट्रोलियम का उपयोग पहचानना

छात्रों को चट्टान का एक टुकड़ा दिखाइए। उनसे पूछिए:
वे कौन-से विभिन्न तरीकें हैं, जिनसे हम चट्टानों का उपयोग करते हैं?

(निर्माण कार्य में, मृदा के बनने में, खनिजों/धातुओं/रसायनों के निष्कर्षण में)

चट्टान का टुकड़ा

क्रियाकलाप 4

छात्रों को लोह अयस्क (हैमाटाइट)/मेग्नेटाइट दिखलाइए। उनसे पूछिए:
यह क्या है?
(यह चट्टान का एक टुकड़ा है)
उनसे कहिए कि यह लोह अयस्क है जो हेमाटाइट/मेग्नेटाइट कहलाता है
स्पष्ट कीजिए कि अयस्क एक पदार्थ है जो पृथ्वी में से खुदाई करके निकाला जाता है और जिससे एक धातु का लाभदायक रूप से निष्कर्षण किया जाता है।
हम अयस्कों को कहां से प्राप्त करते हैं?
(चट्टानों से)

सामान्यतः हम गहराई तक खोद कर पृथ्वी में से अयस्क प्राप्त करते हैं। कभी-कभी यह भूमितल पर चट्टानों और मृदा आदि के रूप में पाया जाता है।

आप के संदर्भ के लिए निम्नलिखित सारणी में कुछ अयस्कों के नाम, उनसे प्राप्त होने वाले धातुओं के नाम के साथ दिए जा रहे हैं।

अयस्क का नाम	प्राप्त होने वाली धातु का नाम
बाक्साइट	ऐलुमिनियम
तांबे का पाइराइट	ताँबा
मेग्नेसाइट	मेग्नेशियम
गेलेना	सीसा
मेग्नेटाइट/हेमाटाइट	लोहा

उनसे कहिए कि कभी-कभी ये अयस्क जिस रूप में प्राप्त होते हैं वैसे ही हम उनका उपयोग करते हैं। उदाहाणार्थ चट्टानी (सेंधा) नमक कभी-कभी हमको इन अयस्कों से अशुद्धियां दूर कर धातुओं का निष्कर्ष करना पड़ता है। इसके पश्चात इनका उपयोग करते हैं।

उनसे पूछिए:
हम खनिजों का उपयोग कैसे करते हैं?
(कृषि, औषधियां, भोजन, धातु कर्म)
हम धातुओं का उपयोग कैसे करते हैं?
(आभूषण, बर्तन, पाइप, इत्यादि)
समझाने का प्रयास कीजिए कि खनिज हमारे लिये बहुत उपयोगी हैं।

क्रियाकलाप 5

छात्रों को कठोर कोयले (पत्थर का कोयला) का एक टुकड़ा दिखाइए। कोयला

उनसे पूछिए:
यह क्या है?
(कोयला)

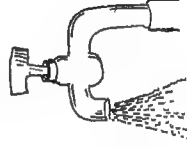
कोयला हम कहां से प्राप्त करते हैं?
(पृथ्वी की भीतरी सतह में कोयले की खानों से प्राप्त करते हैं)
कोयले के भिन्न-भिन्न उपयोग कौन-कौन से हैं?
(ईंधन, औषधियां, आदि)

क्रियाकलाप 6

छात्रों को दिन-प्रतिदिन के जीवन में पैट्रोल, डीजल और औधधि आदि के उपयोग करने के अवलोकनों का स्मरण कराइये। उनसे कहिए कि पैट्रोल और डीजल जैसे पदार्थ पेट्रोलियम के उत्पाद हैं। पैट्रोलियम काला श्यान द्रव है जो खुदाई करके पृथ्वी से निकाला जाता है।
पैट्रोलियम के अन्य उत्पाद कौन-कौन से हैं?
(वेसलिन, बेंजीन, तारकोल, खाना पकाने की गैसें, गैसोलिन आदि)
हम इन उत्पादों का उपयोग कैसे करते हैं?
उन्हें समझाने का प्रयास कीजिए कि चट्टानें, खनिज, पैट्रोलियम और कोयला ऐसे महत्वपूर्ण भूमिगत प्राकृतिक संसाधन हैं, जिनका उपयोग मानव द्वारा बहुतायत में किया जाता है।

7.3: प्राकृतिक संसाधनों के संरक्षण की क्या आवश्यकता है?
केंन्द्रित करें: प्राकृतिक संसाधनों का संरक्षण

(कालांश 1-2)

अधिगम परिणाम	प्रस्तावित शिक्षण प्रक्रम	साधन एवं सामग्री
	क्रियाकलाप 1	
प्राकृतिक संसाधनों के संरक्षण की आवश्यकता को पहचानना	छात्रों को सड़क के किनारे खुला छोड़ दिए गये जल के नल के अवलोकन का स्मरण कराइए। उनसे पूछिए: क्या होगा यदि सभी जल की टोंटियां खुली छोड़ दी जायें? (देर-सवेर जल की आपूर्ति समाप्त हो जाएगी) छात्रों से कहिए कि जल की आपूर्ति (सप्लाई) एक संग्रहक टंकी द्वारा की जाती है, जिसमें जल का परिमाण सीमित होता है। यदि जल का लगातार उपयोग किया जाएगा तो जल शीघ्र ही समाप्त हो जाएगा। क्या होगा जब जल समाप्त हो जाएगा? (हम जल को पीने के लिये तथा अन्य लाभदायक प्रयोजनों हेतु उपयोग करने से वंचित हो जाएंगे) उन्हें समझाने का प्रयास कीजिए कि ठीक इसी प्रकार प्राकृतिक संसाधन भी सीमित हैं, इसीलिए इनका उपयोग विवेक पूर्वक होना चाहिए। इनका बचाव आवश्यक है।	

7.4: प्राकृतिक संसाधनों के संरक्षण के लिए क्या उपाय है?

केंन्द्रित करें: प्राकृतिक संसाधनों का संरक्षण

(कालांश 1-2)

अधिगम परिणाम	प्रस्तावित शिक्षण प्रक्रम	साधन एवं सामग्री

क्रियाकलाप 1

प्राकृतिक संसाधनों के संरक्षण हेतु विभिन्न उपायों को पहचानना

छात्रों के प्रतिदिन के जीवन में प्राकृतिक संसाधनों के दुरूपयोग के अवलोकनों का स्मरण कराइए। निम्नलिखित सारणी को भरवाने में छात्रों की सहायता कीजिए। इसे आपके संदर्भ के लिए आंशिक रूप से भर दिया गया है।

प्राकृतिक संसाधन	दुरूपयोग/प्रदूषण के ढंग	संरक्षण के उपाय
वायु	धुंआ, धूल,	धुंआ और धूल को कम करना
जल	जल के नलकों को खुला छोड़ना, कूड़ा कचरा फेंकना, गंदा जल मिल जाना	ठीक से उपयोग के बाद जल के नलों को बंद करना, कूड़ा कचरा न फेंकना, गंदे जल को न मिलने देना
पेड़-पौधे	विवेक हीन कटाई और जड़ से उखाड़ फेकना	पेड़-पौधों का न काटना और न जड़ से उखाड़ फेंकना
जन्तु	खाल और भोजन हेतु मार डालना	जन्तुओं को न मारना
चट्टानें	----------	----------
खनिज	----------	----------
पेट्रोलियम	----------	----------
सूर्य का प्रकाश	----------	----------
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7.5: नवीकरण योग्य और अनवीकरण योग्य संसाधन कौन-कौन से हैं?

केंन्द्रित करें: नवीकरण योग्य संसाधन और प्रकृति में प्रदूषण

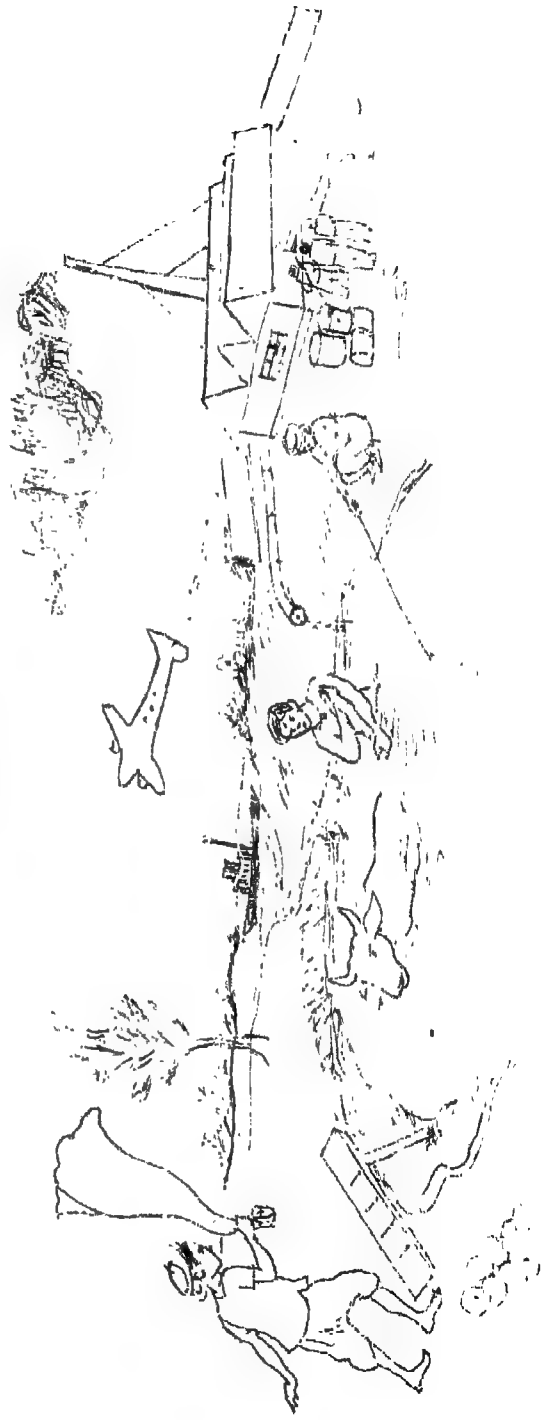
(कालांश 1-2)

अधिगम परिणाम	प्रस्तावित शिक्षण प्रक्रम	साधन एवं सामग्री
नवीकरण योग्य और अनवीकरण योग्य शब्द का अर्थ समझना और नवीकरण योग्य संसाधनों को पहचानना	क्रियाकलाप 1 कक्षा 3 के क्रियाकलाप 4.3.3 में जल चक्र के संदर्भ में छात्रों के अनुभवों का स्मरण कराइए। पूछिए जल को क्या होता है जब वह उबलता है? कीप की भीतरी सतह पर भाप क्यों द्रवित होती हैं? उन्हें निष्कर्ष निकालने में सहायता कीजिए कि जल एक नवीकरण योग्य संसाधन है। जल के स्रोतों से जल वाष्पित होकर ऊपर उठता है और ऊंचाई पर पहुंच जाता है। जल वाष्प द्रवित होकर वर्षा के रूप में पुनः पृथ्वी पर गिर जाता है। नवीकरण योग्य संसाधन सतत उपलब्ध रहते हैं। इन्हें अल्प समय में पुनः प्राप्त किया जा सकता है। अनवीकरण योग्य ऊर्जा के संसाधनों की आपूर्ति सीमित है और इनकी पुनः आपूर्ति में बहुत अधिक समय लगता है। छात्रों से पूछिए: अन्य कौन से नवीकरण योग्य संसाधन हैं? अनवीकरण योग्य संसाधन कौन से हैं?	

निम्नलिखित सारणी को छात्रों से भरवाइए। इसे आपके संदर्भ के लिये भर दिया गया है।

नवीकरण योग्य संसाधन	अनवीकरण योग्य संसाधन
वायु	पेट्रोलियम
जल	धात्विक अयस्क
वन	मृदा
जन्तु अपशिष्ट	कोयला
सूर्य प्रकाश (सौर-ऊर्जा)	

जानना कि वायु और जल चूंकि नवीकरण योग्य संसाधन है इन्हें प्रदूषित नहीं करना चाहिए

क्रियाकलाप 7.4.1 में वायु तथा जल के संरक्षण विभिन्न उपायों के संदर्भ में छात्रों को स्मरण कराइए क्योंकि इनका बचाव हमारे जीवन के लिये आवश्यक है। उन्हें समझाइए कि मानव के कुछ क्रियाकलाप अथवा कृति द्वारा अथवा प्रकृति द्वारा वायु और जल नवीकरण योग्य हैं जबकि अन्य संसाधनों का नवीकरण बहुत कठिन होता है।

परिशिष्ठ 1

कक्षा 5 के लिए पर्यावरणीय अध्ययन-विज्ञान हेतु शिक्षक पुस्तिका की पाण्डुलिपि तैयार करने, समीक्षा, संशोधन करने एवं अंतिम रूप देने के लिए विभिन्न स्तरों पर दिल्ली में वर्ष 1987-88 में आयोजित कार्यशालाओं के प्रतिभागी

सलाहकार समिति
प्रो. एस.एन. दत्ता, भूतपूर्व अध्यक्ष
श्रीमति शुक्ला भट्टाचार्य
डा.जे.सी. गोयल
श्री के.बी. गुप्ता

सम्पादक दल
डा.राज
श्री ए, चक्रवर्ती
(चित्रांकनकर्त्ता और कला सम्बन्धित कार्य)

डा.पी.के. भट्टाचार्य
परियोजना समन्वयक
श्री वी. वाईसर
(शैक्षिक परामर्शदाता एवं जर्मन दल नेता)

डा. बी.के. शर्मा
(शैक्षिक दल समन्वयक)

1. कु. देवयानी अग्रवाल
   केन्द्रीय विद्यालय
   पुष्प विहार
   साकेत
   नयी दिल्ली
2. श्री जे.पी. अग्रवाल
   विज्ञान शिक्षा विभाग
   एस.सी.ई.आर.टी.
   3 लिंक रोड़, करोल बाग
   नयी दिल्ली
3. श्री जयपाल सिह अरूण
   एम.सी. प्राइमरी (एम.सी.डी.) स्कूल
   कमला नगर
   दिल्ली
4. डा.बी.डी. अत्रेय
   22 ए.जी. सी. आर. एन्कलेव
   नयी दिल्ली
5. श्री यशपाल चड्ढा
   एम.सी. प्राइमरी (एम.सी.डी.)
   स्कूल, कमला नगर
   दिल्ली
6. श्रीमती स्निग्धा चन्द्रा
   एयर फोर्स बाल भारती स्कूल
   लोदी रोड़
   नयी दिल्ली
7. श्रीमती प्रीति चावला
   एयर फोर्स बाल भारती स्कूल
   लोदी रोड़
   नयी दिल्ली
8. श्रीमती उर्मिला धर
   केन्द्रीय विद्यालय
   एन.सी.ई.आर.टी. परिसर
   नयी दिल्ली
9. श्रीमती आर. गोसाई
   आर्मी पब्लिक स्कूल
   रिंज रोड़, धौला कुंआ
   नयी दिल्ली

10. श्रीमती दीपिका गुरनानी
एन.डी.एम. सी. जूनियर
नवयुग स्कूल, लक्ष्मीबाई नगर
नयी दिल्ली

11. श्रीमती उषा जगोटा
केन्द्रीय विद्यालय
जे.एन.यू. परिसर
नई महरौली रोड़
नयी दिल्ली

12. श्रीमती रेनु जुनेजा
भारतीय विद्या भवन
कस्तूरबा गांधी मार्ग
नयी दिल्ली

13. श्रीमती शशी किरन कपूर
केन्द्रीय विद्यालय
एन्ड्रूज गंज
नई दिल्ली

14. श्रीमती ज्योति कटारा
ए.पी.जे. स्कूल
शेख सराय
नई दिल्ली

15. श्रीमती विनिता कौल
बिरला विद्या निकेतन
पुष्प विहार
साकेत
नई दिल्ली

16. श्रीमती प्रोमिला मदान
भारतीय विद्या भवन
कस्तूरबा गांधी मार्ग
नई दिल्ली

17. श्रीमती प्रभा माथुर
केन्द्रीय विद्यालय
सेक्टर 2, आर.के. पुरम
नई दिल्ली

18. श्रीमती विनिता मेहरा
दिल्ली पब्लिक स्कूल
एफ ब्लाक, ईस्ट आफ कैलाश
नई दिल्ली

19. श्रीमती जया मेहता
मदर इन्टरनेशनल स्कूल
श्री अरविन्द मार्ग
नई दिल्ली

20. श्रीमती श्यामला मेनन
होली चाइल्ड आल इण्डिया
सीनियर सैकन्डरी स्कूल
टैगोर गार्डन
नई दिल्ली

21. श्रीमती अनिता पॉल
ए.पी.जे. स्कूल
शेख सराय
नई दिल्ली

22. श्री जोस पॉल
टीचर सेन्टर
एजूकेशनल प्लेनिंग ग्रुप
सेंट जेवियर स्कूल परिसर
4, राजनिवास मार्ग
दिल्ली

23. श्रीमती सुधा पुरी
सेंट ज़ेवियर स्कूल
4, राज निवास मार्ग
दिल्ली

24. श्रीमती सरोजा, रामचन्द्रन
दिल्ली पब्लिक स्कूल
वसन्त विहार
नई दिल्ली

25. श्रीमती दरशन सैनी
एन.डी.एम.सी. प्राइमरी स्कूल न. 1
बाबर रोड़
नई दिल्ली

26. श्रीमती नीरू सेठ
एन.डी.एम.सी. प्राईमरी स्कूल
मेडिकल इन्सटीटयूट
नई दिल्ली

27. श्रीमती उषा शंगेरी
केन्द्रीय विद्यालय
पुष्प विहार
साकेत
नई दिल्ली

28. कु. ममता शर्मा
केन्द्रीय विद्यालय
जे.एन.यू. परिसर
नई महरोली रोड़
नई दिल्ली

29. श्री मुकेश कुमार शर्मा
एम.सी. प्राइमरी (एम.सी.डी.) स्कूल
शास्त्री नगर
शाहदरा
दिल्ली

30. श्रीमती उषा शर्मा
केन्द्रीय विद्यालय
एन.सी.ई.आर.टी. परिसर
नई दिल्ली

31. श्री वीरेन्द्र कुमार शर्मा
एम.सी. प्राईमरी (एम.सी.डी.) स्कूल
गीता कालोनी
दिल्ली

32. श्री ब्रह्म सिंह
एम.सी. प्राईमरी (एम.सी.डी.) स्कूल
अनारकली II
शाहदरा दक्षिण
दिल्ली

33. श्री जगरूप सिंह
एन.पी. प्राईमरी छात्र (एन.डी.एम.सी.)
स्कूल नं. 1
लोदी रोड़
नई दिल्ली

34. श्री ओम वीर सिंह
एम.पी. प्राइमरी (ए.एम.सी.डी.)
स्कूल पूर्वी लक्ष्मी मार्केट
दिल्ली

35. श्री सत्यपाल सिंह
एम.सी. प्राइमरी (एम.सी.डी.)
स्कूल
पूर्वी लक्ष्मी मार्केट II
दिल्ली

36. श्रीमती सरोजा श्रीनिवासन
रामजस स्कूल
सैक्टर 4,
आर.के. पुरम
नयी दिल्ली

37. श्रीमती सरोजा सुन्दराजन
टीचर्स सेन्टर
स्प्रिंग्जेल स्कूल
पूसा रोड़
नयी दिल्ली

38. श्रीमती सन्तोष ठाकुर
एन.पी. प्राइमरी (एन.डी.एम.सी.)
स्कूल न. 2
हेवलॉक एस्कवायर
नयी दिल्ली

39. श्रीमती वी. तिरूमलाई
होली चाइल्ड आल इन्डिया
सीनियर सैकेन्ड्री स्कूल
टैगोर गार्डन
नयी दिल्ली

40. श्रीमती विभावासुदेव
दिल्ली पब्लिक स्कूल
मथुरा रोड़
नई दिल्ली

41. डा. भूपेन्द्र सिंह
गवरमेंट छात्र सीनियर सैकन्डरी स्कूल
अशोक नगर
नई दिल्ली

42. डा. एस.पी. दुबे
रामजस कालेज
दिल्ली विश्वविद्यालय
दिल्ली

43. डा. श्रीमति अरूणा मोहन
गार्गी कालेज
सिरी फोर्ट रोड़
नई दिल्ली

44. डा. राज
नवयुग स्कूल
सरोजनी नगर
नई दिल्ली

शैक्षिक दल

मध्य प्रदेश

श्री एस.बी. गुप्ता
श्री वाई.एस. डण्डोतिया
श्री जी.आर. सरवाईकर

उत्तर प्रदेश

श्री आर.एस. रस्तोगी
श्री एस.एस. श्रीवास्तव
श्री एस.के. श्रीवास्तव
श्री वी.एस. कटियार
श्री बी.बी. विश्वकर्मा
श्री एच.के.एल. शाह
श्री जे.सी. मिश्रा

रा.शै.अ.प्र.प.

डा. वी.के. शर्मा
(शैक्षिक दल समन्वयक)
डा. एच. ओ. गुप्ता
डा. एस.सी. जैन
श्री ए.के. गुप्ता, जे.पी.एफ.
श्री ए.के. शुक्ला, जे.पी.एफ.

परिशिष्ट 2

कक्षा .5 के लिए पर्यावरणीय अध्ययन-विज्ञान हेतु शिक्षक पुस्तिका तथा प्राथमिक विज्ञान किट के अभिविन्यास एवं परीक्षण कार्यक्रमों में उत्तर प्रदेश, मध्य प्रदेश और दिल्ली में अप्रैल/मई 1988 में आयोजित कार्यक्रमों के प्रतिभागी

1. श्री महेश बगवाईया
   शासकीय प्राईमरी स्कूल
   मुल्लानी
   सिहोर (म.प्र.)
2. श्री अशोक चौहान
   शासकीय सुभाष मिडिल स्कूल
   सिहोर (म.प्र.)
3. श्री मनोहर गुप्ता
   शासकीय प्राईमरी स्कूल
   इमलिया नरेन्द्र
   सी.न. 2, वेरसिया
   भोपाल (म.प्र.)
4. श्री आर.जी. नेमा
   चन्द्रशेखर आजाद मिडिल स्कूल
   भोपाल (म.प्र.)
5. श्री ओ.पी. शर्मा
   शासकीय प्राईमरी स्कूल
   सिक्योर्टि लाइन्स
   भोपाल (म.प्र.)
6. श्री जे.एन. श्रीवास्तव
   शासकीय मिडिल स्कूल
   अरेरा कालोनी
   भोपाल (म.प्र.)

7. श्री बसन्त सिंह
कस्तूरबा हाई स्कूल
भोपाल (म.प्र.)

8. श्री एस.वी. सिंह
शासकीय विवेका हाई स्कूल
सिहोर (म.प्र.)

9. श्री सी.पी. सिंह
शासकीय प्राईमरी स्कूल
बिजौरा (म.प्र.)

10. श्री शैलेन्द्र श्रीवास्तव
शासकीय गर्ल्स प्राईमरी स्कूल
सी.न. 1, बेरसिया
भोपाल (म.प्र.)

11. श्रीमती सुमन ठाकुर
शासकीय संजय गांधी मिडल स्कूल
भोपाल (म.प्र.)

12. श्री राज बहादुर
जूनियर बेसिक विद्यालय
तुलसी पुर
इलाहाबाद (उ.प्र.)

13. श्रीमती आशा ईसुवियुस
राजकीय बेसिक डिमोस्ट्रेशन स्कूल
सी.पी.आई.
इलाहाबाद (उ.प्र.)

14. श्री लाल बहादुर जायसवाल
जूनियर बेसिक विद्यालय
नेनी बाजार
इलाहाबाद (उ.प्र.)

15. श्री सुरेश नारायण मिश्रा
प्राईमरी पाठशाला
फाफामाऊ
इलाहाबाद (उ.प्र.)

16. श्री कमलेश नारायण मिश्रा
प्राईमरी पाठशाला
करेलाबाग गांव
इलाहाबाद (उ.प्र.)

17. श्री कृपा शंकर मिश्रा
जूनियर बेसिक विद्यालय
रिजर्व पुलिस लाइन
लखनऊ (उ.प्र.)

18. श्री राम विलास मिश्रा
जूनियर बेसिक प्राईमरी स्कूल
सादतगंज
लखनऊ (उ.प्र.)

19. श्री शिव दरशन मिश्रा
राजकीय शोध विद्यालय
(एस.आई.ई.से जुड़ा हुआ)
इलाहाबाद (उ.प्र.)

20. श्री शारदा प्रसाद तिवारी
प्राईमरी पाठशाला
इस्माइल गंज
लखनऊ (उ.प्र.)

21. श्रीमती शरदा शर्मा
जुनियर बेसिक विद्यालय
चिनहट
लखनऊ (उ.प्र.)

22. श्री राधे श्याम
प्राइमरी पाठशाला
कौड़िहार
इलाहाबाद
(यू.पी.) उ.प्र.)

23. श्री प्रभाशंकर शुक्ल
बेसिक प्राइमरी पाठशाला
निटगतगंज
लखनऊ
(उ.प्र.)

24. श्री राम कमल शुक्ल
आदर्श विद्यालय
(संलग्न रा.इ.का.)
लखनऊ

attained in western Asia by this time that oriental notabilities came by every caravan and sea route to see him in person, from even as far inland as Tartary and Kurdistan; but in the midst of an atmosphere of fame and wonder, such as probably no white man in the east has ever since so fully experienced, his health suddenly gave way so completely that he recognised he had very little longer to live. Ten years of incessant and anxious labour, begun in an unhealthy climate at the age of sixty-three, had broken him up at last, and having transacted with rapidly failing powers such business as remained to be done at Ormuz he sailed for Goa, which he was most desirous of reaching before his fast-approaching end.

It so happened that his successor, Lopes Suarez—of whose appointment as Viceroy the Captain-General knew nothing—had already arrived at Cochin with the annual fleet a few weeks before. For years past an envious but influential faction at Lisbon had intrigued against Albuquerque, and the irresolute King had at length credited the industriously circulated defamation of his character and decided to recall him. It may have been difficult for a man of Manoel's mediocre powers of discernment to sift the true from the false among all the plots and parties surrounding the throne; but in giving Albuquerque no chance to answer his accusers before taking drastic action on their reports he was certainly guilty of an unpardonable injustice to the best among the band of brilliant servants who held his commission. And very shortly afterwards his proceedings presented him in an even worse light as a vacillator who was guided by fears for the future rather than gratitude for the past. Within a couple of months from the departure of Suarez a highly sensational rumour reached Lisbon from Venice—where from motives of self-interest it had probably originated—to the effect that the Suez armada was fitting out again for India in great strength. Much disturbed by this intelligence Manoel despatched a reinforcing fleet of twelve ships for the East at once, and by them he sent a letter to Suarez, informing him that although he would retain the title and emoluments of Viceroy, his actual authority was to be confined to the minor land settlements of Cochin, Cananore and

Malacca—all subordinate responsibilities—while, until further instructions, Albuquerque, though only holding the status and pay of Captain-General, would remain in supreme command of Goa and of all naval and military forces of Portugal in the Indies, in order that, in Manoel's own words, the greatest danger which could threaten the Portuguese position in the East should be met by a man of proved competence. Thus at the very time when his sovereign was removing Albuquerque to make room for a favourite he was relying upon him to save a threatened situation. In the end nothing came of this ambiguous arrangement, for the rumour proved false and Albuquerque was dead before these orders reached Suarez, but the stigma on the King's name remains in history. In justice, however, it must be said that he heaped honours on the Captain-General's only son.

Albuquerque received the first intimation of his supercession on the voyage to Goa from a native vessel making from Cochin to Muscat, which he communicated with at sea. To find that after ten years of exceptionally meritorious services to his country the King regarded him as deserving of censure produced a most depressing effect on the few remaining days of his life, and when the ship anchored in the outer harbour of Goa late in the evening of 15th December, 1515, he was sinking fast. Early next morning he died in the full dress of a Commander of Santiago, and was buried at Goa amid extraordinary scenes of feeling in which the Hindoos bore quite as large a part as his own countrymen.

With the close of this remarkable man's life ended a very definite chapter in the history of the Indian Ocean. Perhaps it has never been quite sufficiently appreciated how much the nations of central and western Europe owe to him as the real founder of the white man's power in the east. Before he took up his vast labours Europe was unrepresented on that part of the earth's surface which lies to the eastward of Africa, except by a small squadron of ships moving within a restricted area, and a handful of officials in three fenced enclosures, any one of which could be walked round in ten minutes; while all around were swarming millions of the brown races whose ships

covered the eastern seas. At Albuquerque's death the white man—though only represented by citizens of one of the smallest European States—stood like a Colossus astride of the Indian Ocean, with one foot in the Malay Archipelago and the other at the gates of Persia: between which points not a vessel dared to show her sails without Portuguese goodwill. And though the Portuguese resisted the determination of other white races to share in this great position afterwards, it was their own pioneering work that cleared the way for all the European flags that followed nevertheless.

In some of its aspects the rule of the Indian Ocean founded by Albuquerque has no precise parallel in history, for it subjected a whole oceanic area to the condition of territorial waters. Other nations with a naval superiority over enemies in war have so far applied it as to drive their enemies off the sea and blockade them in port, but none even in war have attempted to set up a permanent regulation of sea traffic applicable to anything afloat in an entire ocean. Albuquerque began at first by a wholesale forced reduction of traffic through his expulsion of the Arab merchants from the eastern seas, but found it more in Portuguese interests to modify this extreme policy by allowing them to trade between Goa and the Persian Gulf, instead of Calicut and the Red Sea, and under a system of licences encouraged the flow of maritime commerce through channels of his own selection. But he recognised both the moral obligation and the expediency of policing the great water space over which he asserted an arbitrary control based on force, and strove to free it from the curse of piracy under which it had suffered from the earliest beginnings of navigation. No sea in the world was safer in that respect, at the time, than the Indian Ocean in the early part of the sixteenth century; and at that period the freighters crossing its surface sailed on their business in more security than their sisters of the Atlantic, Pacific or Mediterranean, always provided that they carried the Portuguese pass. For these safe conducts they were charged substantial fees, and here again in levying a tax on oceanic navigation applicable within certain vastly extended geographical limits to all vessels but their own, the Portuguese

action was historically unique; but the trade was so lucrative that it easily carried the impost, and an Arab shipowner confessed to Albuquerque that he could afford to lose a dozen cargoes of Malabar pepper for every one which he landed at Jeddah or Suez. Fifteen hundred per cent. was a not uncommon profit for one voyage.

In matters of general policy his strategic breadth of outlook enabled Albuquerque to keep essentials consistently in view, and through his understanding of the necessary limitations of Portuguese power in so immense a field of enterprise he never attempted—in spite of a natural bent for adventure—to undertake the conquests of great blocks of Asiatic territory like the Dutch, British and French. Wherever he planted or helped to plant the flag of his country, the sea was either actually visible, or at most within a couple of hours' march; in which respect he steered a middle course between the policy of his predecessor Almeida on the one hand and his successor Suarez on the other. Almeida was opposed to any addition to the two original Portuguese footholds on the land at Cochin and Cananore. Suarez came to an agreement with the principal of the three kings dividing the rule of Ceylon, whereby the greater portion of that island, amounting to an area equal to more than half Portugal itself, was added to the realms acknowledging the sovereignty of the Portuguese crown as tributary states. No effective military occupation of so extensive an acquisition of territory was within the power of the Lisbon government, but they could cut off its external commerce, and for a long time that proved a sufficient means of controlling the interior through native rulers, as well as the coast. At a later stage, however, rebellions far inland involved them in military operations absorbing more than all the profits of tribute and trade, which was precisely the nature of eventuality that Almeida and Albuquerque had apprehended.

One fatal mistake, however, Albuquerque did commit with the best intentions, which went far towards undoing his own great work in after years. He was directly responsible for racial adulteration on a scale that proved one of the main causes of the ultimate decay of Portuguese power in the Orient.

The men he led himself so often to triumph were all full-blooded whites born of Lusitanian mothers; but with the idea of manning the fleets and forts under the Portuguese flag in the East with a locally raised *personnel*, he deliberately encouraged the marriage of these men to the daughters of Malabar Hindoos, the least virile of the eastern races with whom he came in contact. The hybrid posterity of these unions provided soldiers and sailors of a type that was good enough—as a rule—for meeting Asiatic enemies, but it was flimsy material with which to face the seamen of Nordic Europe, who arrived a few generations later to contest the Portuguese supremacy of the eastern ocean, especially as the stock was still further watered with the passage of time.

Though not a sea officer from youth Albuquerque's career as a war commander was almost entirely naval in character, or directed towards objects having an immediately maritime purpose, such as the acquisition of bases for fleets and freight storage. But in spite of this, fate denied him the opportunity of ever proving his capacity as a fleet tactician, for although his many engagements involved conflict with great numbers of enemy vessels, these were either encountered at anchor or singly, and he never fought a hostile fleet in open sea like da Gama, or his own subordinate Andrade and many later commanders of the Malacca Division. On the other hand, few admirals have dealt with wider problems of attacking rival sources of wealth through control of sea communications, and none have conducted so much coastal warfare of the kind which stands quite distinct from mere raids. He never had to fence for the weather gauge, but no man ever led a fleet into action so often with the leadsman calling the soundings; than which nothing is so distracting to the nerves of a seaman when manœuvring to attack in uncharted water. Striking directly at the land from the sea Albuquerque might almost be described as the commander whose strategy was naval and tactic military.

He was singularly free from avarice, and the intrinsic value of the share which he kept for himself of the immense booty taken in his operations was almost negligible. As a disciplinarian he was strict and used the brutal punishments in vogue

at that period, but proved extremely forbearing towards those whose offence was disrespect towards himself. And in spite of his conquering activities he left a name held in the highest reverence by Asiatics for generations afterwards, who discerned in him a man recognising that power has its duties as well as its advantages. Unceasingly though he laboured to promote the supremacy of Portugal, it was always his aim to make it a source of prosperity to those who came under it; and so deeply did this impress the natives that for years after his death they were in the habit of invoking his spirit as a protection against the tyrannies of his successors.

Here and there may still be seen traces of the work of Albuquerque. Goa still flies the Portuguese flag, and at a few widely-separated points crumbling walls overlooking the eastern seas indicate the sites of his citadels, long since abandoned to a decay of which he did not live to witness even the beginning. At his death these were among the new and visible signs of the rule of his country, as established by him throughout that immense oceanic area in the history of which his name still occupies the foremost place.

VII

THE CENTURY of PORTUGUESE SUPREMACY in the INDIAN OCEAN

FOR a term of almost exactly one hundred years after Vasco da Gama first anchored in a harbour of India the Portuguese remained the sole representatives of Europe in the eastern seas; and this period happened to coincide very closely with the precise span of the sixteenth century, for whereas da Gama's outward voyage came to a finish about a year and a half before that century opened, the first Dutchmen rounded the Cape about a year and a half before its close. After the establishment of the great commercial and defensive organisation evolved by the genius of Albuquerque, they occupied what might be described in strategic language as a position facing north, resting on the water throughout, although with footholds on shore, and extending over a front of roughly 5000 miles along the northern coasts of the Indian Ocean, from Aden on the left or western hand to Malacca on the right or east. Across the entire length of this line the European envisaged the Asiatic, and at many points came into contact with him as friend or foe.

On their own side of the clear-cut and unchanging natural trace dividing land and sea, the Portuguese when they chose were always able to keep their interior and posterior lines of communication absolutely secure against interruption, so long as they only had Asiatic rivals to face. But that could only be effected by the maintenance of sufficient naval force at all the important points, which they sometimes failed to provide through errors in judgment. Wherever an adequate display of ships was present, there peace reigned and trade flourished. But the knowledge of the superior fighting design of their individual models over any type of native vessel occasionally engendered over-confidence and this, in conjunction with their business desire to utilize as many craft as possible for trade, sometimes led them to reduce a squadron or division, stationed for protective purposes at some particular strategic base, below the margin of safety. Whenever that happened one or more

of the neighbouring natives States was always on the watch to strike a blow at the weakened point; not with any hope of permanently getting rid of the white man's presence, but solely for the sake of plunder or revenge. These encounters were not infrequent, and caused the Portuguese occasional temporary losses, especially through dislocation of local trade, but, as long as their general command of the Indian Ocean remained unshaken, local reverses were invariably remedied sooner or later by the arrival of reinforcements and relief in the area of disturbance. It was as if that great water-space was an empire with frontiers which could be rendered impregnable against direct attack by the use of highly mobile defensive forces, whose concentration on any threatened point the enemy was absolutely powerless to prevent; though the elements might cause its delay. The monsoons, by rendering the despatch of fleets towards certain directions impracticable for months at a time, compelled the Portuguese to submit to a corresponding dispersal of strength, which under other conditions would have been unsound, but behind that lay a reserve of moveable power that always came into play with the change of season, and so enabled them to be ultimately superior anywhere. Thus although the Malays to the east, and the other Moslem nations to the west, were permanently inimical and often actively hostile, their incapacity to combine invariably left them exposed to defeat in the end, even if at times they gained a momentary advantage; and the undisputed maritime superiority of the Europeans not only enabled them to select their points of contact with the Asiatics exactly as they pleased, but owing to the great mobility of fleets—in which Raleigh was the first to discern their potential influence on war—invested them with the power to dominate 5000 miles of coastline along which lived some fifty million people. A somewhat parallel situation was presented during the same period by the command of the shores of the American continent in the hands of Spain; but most of those shores were inhabited by primitive savages, whereas many of the races whom the Portuguese faced across the high water mark of the eastern seas had reached a comparatively advanced degree of prowess in arms on the land at least.

This era of an undisturbed monopoly in eastern commerce marked the zenith of prosperity in the history of Portugal. The entire business in all its branches remained under government, subject to the immediate authority of the sovereign; and although at a much later stage an attempt was made under crown patronage to float a chartered company as a substitute for official control, on the system which was successfully adopted by the British and Dutch, it met with no private support from the public, who always regarded oversea enterprise as within the proper domain of national administration. The State treasury reaped an immense harvest in consequence from the sale of eastern produce in Lisbon, whither the merchants from all parts of Europe flocked to buy; but the nature of the commodities which gave rise to the strenuous trade rivalry of the sixteenth and seventeenth centuries seems curiously trivial in the economic conditions of the present day, when the severe competition for the real necessaries of existence lies so much at the root of all international relationships. In our own time the welfare of civilisation is largely dependent on the transport and exchange of staple foodstuffs; raw materials for clothing, such as wool and cotton; and various descriptions of fuel. But in the sixteenth century all Europe, high and low, was clamouring for pepper and cloves, Asiatic-grown luxuries arriving only in very small quantities through Egypt and Mesopotamia, before the Cape route was discovered.

By the sale of pepper and cloves brought direct by sea the Portuguese prospered in consequence so highly that for a period their national wealth compared not unfavourably with that of far greater and more populous monarchies. Spain amassed riches by laying ruthless hands on South American gold and silver mines, Portugal during the same era by loading peppercorns in Malabar and selling them at 500 per cent. net profit on the Tagus; for so pronounced was the craving for spices among all classes in the west, as a seasoning for a monotonous and flavourless diet, that their price was high in proportion. For spices, accordingly, men faced death by shipwreck or the sword, and hazarded some of the most remarkable exploits in the early annals of oceanic navigation. In nine-

tenths of the written treaties between the Kings of Portugal and the various reigning Princes of Hindustan, the matter of pepper came up almost in the first clause, and in quite a considerable number it was the only subject to receive attention at all. Spices were the Golden Fleece of the Orient, and not even the story of the adventures of Jason in search of the article of classic legend exceeds in romance the epic of Vasco da Gama and his successors in their quest for sackfuls of these pungent little seeds; to obtain which the Portuguese eventually extended their commercial exploration right southwards through the rock strewn passages of the Malay Archipelago, till they were approaching unaware the northern shoreline of Australia.

Speaking generally, it was their policy to spread their mercantile net as widely as possible in the regions on the north and east of the Indian Ocean—in which directions lay the lands where the commodities they sought were chiefly to be found—while holding the approaches from the westward against the threat of Moslem incursion. Although not to be ignored for its marketable value, the produce of Arabia and Persia was of much less importance as a source of wealth than the produce of Hindustan and the Malay countries; and the comparatively small number of Portuguese vessels that were despatched to embark cargoes in the ports to the westward of India seldom actually entered either the Persian Gulf or Red Sea, but anchored at Ormuz or Muscat—and at one period at Aden—to load up the goods deposited at their warehouses by the native coasters from the surrounding area. But the exits from the Persian Gulf and Red Sea required incessant watching, for behind them lay the lands of the Arabs—who were always scheming to retrieve their lost trade with India and China—and their Turkish conquerors, who became ambitious of extending the Ottoman power towards Hindustan. And thus, although orders from Lisbon directed the successors of Albuquerque to keep constantly pushing forward on the Malay side, they were instructed to remain content on the Arabian side with the positions Albuquerque had captured; except to form an eventual alliance with the Sheikh of Aden, whose independence was threatened in the course of time by the

Turkish invaders of Egypt, and whose original hostility to the Portuguese was turned thereby to friendship in the hope of their support.

Along the coasts of Hindustan the Portuguese gradually extended their footing year after year, till almost every anchorage where the embarkation of freight was possible had its Portuguese factory or depôt; and as their ships forcibly prevented any native vessels from using these harbours, except with Portuguese passes on payment of a substantial consideration, the peoples of India had no option but to trade with the white man if they wished to trade at all. In this way the whole export business of India had fallen into the hands of Lisbon agents before the century was half through; and there it remained until other Europeans made their appearance on the scene in the century following and in their turn seized it from the Portuguese. In the Malay Archipelago the Lisbon monopoly of commerce was for a time contested by Spanish ships arriving from Panama across the Pacific; but as the Spaniards were never traders in the true sense, and were much more engrossed with their expansion of empire in America, this competition was not so harmful to Portuguese interests as it might otherwise have been. Starting therefore from their commercial base at Malacca, they worked steadily southward through the islands on that side of the Indian Ocean, and within fifty years of Albuquerque's capture of Malacca had established half-a-dozen trading outposts at widely separated points in the Archipelago.

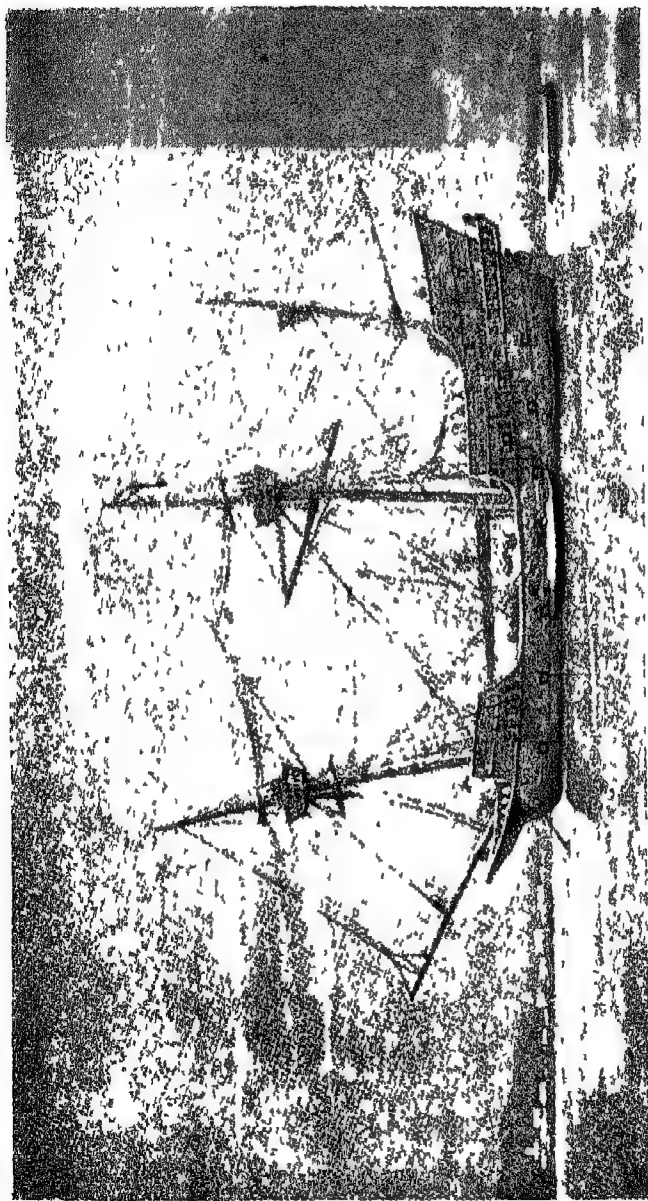
By the eastern nations the spectacle of the white man's assumption of rule over the entire Indian Ocean was viewed with feelings which varied in accordance with its effect on the particular interests of each. Broadly speaking, most of the Asiatic races with whom the Portuguese came into contact were separated into two general divisions from a mercantile standpoint; one division consisting of those who produced the export commodities of the east, and the other of those who bought them at first hand and transported them for a second sale elsewhere. In the first category came nearly all the coastal population of India, and a considerable portion of the peoples of the Malay Archipelago. In the second came the seafaring

elements on the north-western side of the Indian Ocean—mainly Arabs—and the inhabitants of the lands which lie between the Indian Ocean and Mediterranean, a mixture of Egyptians, Syrians, Levantines and southern Turks, known comprehensively to the Portuguese as "Rumes." The producing sections were not greatly concerned as to whether they sold their goods to Arabs or Europeans, so long as they fetched a fair price; and though some of their principal rulers were apprehensive of Portuguese conquest, the industrial and agricultural masses shared this fear very little. The transporting section, however, found themselves being supplanted as the commercial middlemen between east and west by the Portuguese, and not unnaturally regarded this European invasion of eastern sea and markets as an unmitigated evil.

Apart from these two commercial categories, a third element was very materially affected, namely, the people and rulers of those Malay islands where existence was maintained rather by predatory methods than by peaceful traffic. Here the arrival of the white man was as deeply resented as it was on the opposite side of the Indian Ocean, not because it interfered with a long-established business intercourse, but because it threatened a long-established system of extortion. Though not ocean-going seamen, like the Arabs, these islanders were quite at home on the water; and being brave and truculent by nature took a full advantage of their geographical position in the passages between the Pacific and Indian Oceans for enforcing a ruthless toll on passing sails. To these obstructionists the transfer of a large part of the freightage flowing through the Straits of Malacca to ships carrying heavy armaments was a great blow. And therefore, although the Malays were incessantly fighting with one another, they were in full agreement in detesting these new developments, and lost no opportunity of showing it.

But whatever the sentiments might be with which Arab, Hindoo or Sumatran regarded the European, all alike realised that the security of his position in eastern ports was due to his power to act as he pleased on the water. If once deposed from the mastership of the sea, on which he frequently and openly took his stand in his discussions with the princes of the east,

his settlements on shore would soon be starved out. Fortunately, however, for the European, no Asiatics had any knowledge of naval warfare as a science, except those of the middle east; and even with that knowledge, the middle east never attained to the true oceanic vision of the Atlantic races. Though not unskilful navigators in their own way, neither the Arabs nor the Malays were ever capable of building a vessel comparable in fighting design to the galleon or frigate, nor did they ever come to understand that a mere mob of ships without organisation or power to manœuvre as a fleet is not a certain instrument of victory. After a time they learnt a little from the European example, but not enough to regain their lost position, and the improvement was almost solely confined to weapons. For naval tactics proper they never displayed the slightest aptitude; and thus it was that the European dominion of the Indian Ocean established by da Gama, Almeida and Albuquerque has never been seriously threatened, except by Egyptians and Turks. Against the Egyptians the Portuguese were able to bring their whole strength, although the attack took place in the very early days of their eastern naval supremacy, because they had no distant positions requiring detached defence; but when the Turks came on the scene at a later stage they were handicapped by calls arising in other parts of their then very widespread eastern position.

For these various reasons, the history of the Indian Ocean during the hundred years following the death of Albuquerque was not a tale of conquest or change like the ten years immediately antecedent, or the century that came after. It was an era of repeated stress and strife, but of stationary general conditions nevertheless; for in spite of being constantly attacked at this point or that, the Portuguese were never permanently driven away anywhere, and even when suffering temporary local reverses always recovered their supremacy sooner or later, except in one instance. To a seaman or a soldier the full account of such a period is often of extreme interest, as illustrating some particular system or policy of defence continually under test; and in this case the details of the methods whereby the white man held his outlying positions is remarkably instructive

PORTUGUESE GALLEON OF THE SIXTEENTH CENTURY

The earliest instrument of European rule in the Indian Ocean

(From a sketch by the author)

professionally. For example, the seven great attacks on the Portuguese seaborne trade and land settlement in the Straits of Malacca, delivered by the various Malay Sultans, are worth a technical book in themselves, quite apart from the operations against the Turks, Arabs and Cingalese. But to the general reader a lengthy series of conflicts which never effect more than a momentary shifting of the alignment on a fighting front, are apt to be as tedious in the narration as the daily reports of a prolonged period of trench warfare, in which cross raiding is incessant but no material change results; and as the treatment of the subject in these pages is neither in the form of a detailed history or a technical commentary, the chronicles of that phase of Indian Ocean history must here be condensed.

As already observed, the general strategic front of the Portuguese position was represented by the northern shores of the Indian Ocean from Aden and Ormuz to Malacca. These three outlying points were the regional centres for the collection and shipment of the produce of their surrounding areas in the holds of the Portuguese Indiamen, after it had been brought in by small native vessels; and to understand the general interests of the Portuguese as they themselves viewed them, it must be borne in mind that cargoes were at this stage always regarded as of more importance than the settlements on shore, which were merely warehouse lots in fortified enclosures to store goods awaiting embarkation, only considered as valuable possessions from the goods they might contain at a time of attack. Even Goa had its prime importance as a trade centre. The loss of one of these points for a few months only involved the destruction of a few warehouses and the deaths of a small staff if it happened to be empty. But if it was full the whole treasury budget in Lisbon might be affected for a year till a second accumulation was completed. On the same principle the protection of the goods afloat in native bottoms destined for landing at the depôts was quite as important as the protection of the depôts themselves.

It was the regular Portuguese practice to despatch the loaded vessels homeward each year in company early in the favourable north-east monsoon—that is to say in the autumn

—so that they might make a good run to the equator. Only a few remained near each of the three above-mentioned outlying points, for the double purpose of protecting the local native craft engaged in bringing in cargoes from the neighbourhood for deposit at the settlement in readiness for the next year's despatch, and for keeping down Arab competition. These guardships were also the chief protection of the settlements, because any enemies powerful enough to attack on land with any prospects of success happened in all cases to be so situated that they had to cross the water first—the settlements in Hindustan being of course an exception. Of the outlying squadrons that which was stationed in the Straits of Malacca was in a somewhat specially isolated position, being cut off from any hope of reinforcement by the monsoon from the time of the departure of the homeward bound fleet in October till the arrival of the next year's fleet in May. The squadrons at Ormuz and Aden could be supported in summer from the Mozambique quarter and in the winter from Goa. As a result at Malacca the exigencies of trade came into conflict with the requirements of strategy, for the greater the accumulation of goods to be carried home the fewer the vessels left behind as a defence. It was always a difficult matter, therefore, for the local commodore to strike a right balance, for if he sent off too many ships he risked the safety of his area, and if he sent off too few he was liable to be called to account by the authorities in Lisbon, whose demands for cargoes were insatiable.

Through this uncertainty the margin of safety was sometimes overstepped and commerce paid the penalties, for within easy striking distance of Malacca lay several large and formidable Malay Sultanates possessed of numerous fleets of proas, all permanently hostile to Europeans. Seizing the favourable opportunities in the winter monsoons, the various rulers of these States attacked the Portuguese with a tremendous superiority in numbers no less than seven times during the sixteenth century. The first attack was delivered by the King of Java in 1514, the second by the Sultan of Bintang in 1518, the third by the very powerful King of Acheen in 1538, the fourth and fifth by his successor in 1572 and 1573, the sixth

by another King of Java in 1574, and the seventh by the King of Acheen again in 1575. Yet other attacks followed in the century after by the Dutch.

The first, fourth and fifth of these enterprises were defeated on the water, after hard fought fleet actions, and failed in every respect; in the other four the small Portuguese squadrons were either destroyed or blockaded in harbour, and the local traffic which they were protecting was held up for the whole season. On each of these four occasions naval success was followed by the landing of an army to capture and plunder the Portuguese settlement, but in no single instance was this effected before the arrival of a relieving fleet, on the spring change of monsoon, forced the Malays to retreat in haste. In every case a handful of Europeans held an outpost of the white race against oriental assailants with a superiority of fifty to one in numbers, and the greatest heroism was displayed. But the impregnability of the walled enclosure on shore on each occasion to every form of assault known to the Malays, was a poor consolation to the Portuguese for the loss of four winter seasons of trade, and to that extent these four raids must be set down as Asiatic successes. The European command of the sea was locally overthrown in an area where it could not be re-established for half a year and the financial blows were severe. Moreover, the effect of these attacks was felt right across the Indian Ocean, because they compelled the Portuguese admirals to strengthen the detached force permanently stationed in the Straits of Malacca at the expense of other points where equally dangerous adversaries had to be faced before many years had passed.

It will be observed from the above dates that the first three attacks took place in the first half of the century, and were divided by a wide interval of time from the last four, which were a series of sledge-hammer blows delivered in quick succession in the second half; and to obtain a proper mental picture of the phases of the general situation they should be grouped in this way. Taught by the successive experiences of the first three, the Portuguese increased the squadron in the Straits of Malacca and enjoyed thirty-six years of security at that end of their line in consequence. Their attention was in fact

focussed on that side, and they even turned the tables on the Sultan of Bintang—a formidable pirate chief at enmity with everybody—by capturing his island and breaking up his forces after a violent tussle and one sanguinary failure.

All this, however, entailed a weakening of their squadrons at the Persian Gulf and Red Sea entrances, and it so happened that during this same half century the Ottoman Turks were carrying their irresistible advance southward from Asia Minor through Syria, Egypt and Mesopotamia, till they reached the heads of the Persian Gulf and Red Sea, where their arrival caused considerable apprehension to the Portuguese Admirals. Being much more scientific seafighters than any of the other eastern races, they represented a menace to the white man's eastern interests needing constant vigilance; although at first they did not exhibit any immediate signs of aggressive intention, and called a lengthy halt at the water's edge, where for a space they remained content with the rôle of spectators of Portuguese maritime activity. Not being in any sense a mercantile people themselves they displayed no inclination to enter into competition with the sea traders, whose industry they had indeed some inducement to leave alone, for the caravan tracks which connected with the sea routes traversed their newly-acquired territories and offered a fine subject for exactions and tolls.

But to the Turks the slow gains derived from customs dues and other similar levies are always less attractive than the rapid profits of successful plunder, and after contemplating the prospect for some twenty years they decided to adopt a more forward policy. Soliman the Magnificent was now on the Ottoman throne, a great monarch whose navy in the Mediterranean had proved so efficient an instrument of rule and conquest that it fired him with an ambition to assert his power in other seas. For a long time he had resented the hold which the Portuguese maintained on the exit from the Persian Gulf by keeping one of their squadrons based on Ormuz; and like the Sultans of Egypt whom his father had conquered and superseded, he kept up a correspondence with such of the western rulers of India as professed the Moslem faith. Chief among these was the King of Gujerat, a grandson of the prince

whose attempt to oust the Portuguese from India in alliance with the Sultan of Egypt had been defeated in the fleet actions of Chaul and Diu. After those defeats the reigning monarch of Gujerat had granted permission to the Portuguese to visit Diu for trade, and in time so completely reversed his anti-European policy that he gave them a site for a settlement of the usual type, which was later enclosed and fortified. His son and grandson, however, were encouraged by Soliman to revert to the original attitude of hostility to Europeans, with the result that the son was killed after a brief reign, in a skirmish with the Portuguese in Diu harbour, and the grandson, on succeeding to power, secretly schemed with Soliman to drive the Portuguese out of Gujerat, if not out of India, by seizing their Diu citadel.

The aggressiveness of Soliman's eastern outlook was evidenced by the building of a fleet of the finest war galleys at Suez, which were certainly not needed for any purposes of defence and compelled the Portuguese admirals to keep a constant watch in that direction with the lessons of Chaul in memory. But since that battle the expansion of Portuguese commerce in the east had been so great that their maritime strength was no longer equal to protecting it from local attack at all points, except by withdrawing tonnage from trade, and the financial loss consequent on such a step promised to be greater than that arising from an occasional Turkish raid. No steps were taken, therefore, to increase the divisions based on Ormuz and Aden; nor did any increase prove to be necessary so long a there was no reduction, for Soliman kept the lesson of Chaul in mind also—and perhaps even more the lessons of the fleet action of Malabar—with no intention of risking repetitions. He was quite ready to engage the Portuguese on land, as he proved more than once; but he knew just enough about naval tactics to realise that, at that period anyhow, the Portuguese knew more, and dreaded the possible combination of weather gauge and long-range gun in the hands of adversaries who could display such spirit as Lorenzo Almeida. His Suez fleet never ventured outside the Red Sea therefore while there was any prospect of encountering the ships of Portugal in respectable force.

But a chance came at last. When the King of Acheen delivered his great attack on Malacca in 1538—of which mention has already been made—the relief of that place called for the services of every Portuguese vessel in Asiatic seas to deal with the Achinese fleet—including the Aden and Ormuz divisions—and left the western half of the Indian Ocean clear of the flag altogether for a time. This occurred moreover during the summer monsoon, which meant that all had sailed to leeward and could not get back till the autumn. Here was Soliman's opportunity, a fair wind to India and not a single enemy to bar the way. News of the departure of the Portuguese vessels from Aden and Ormuz having soon reached him he despatched express orders to his namesake, Soliman Pasha—who commanded the Red Sea fleet—to sail to Gujerat at once, plunder the Portuguese settlement at Diu in alliance with the Gujerat army, and return to Suez on the change of monsoon with all the spoil and prisoners he could collect before the Portuguese came back westward from Malacca.

It was a vain enterprise however, because it relied for success on evading the Portuguese fleet instead of defeating it; a cardinal error in sea strategy, which meant that unless Diu could be reduced before that fleet appeared on the scene it could not be reduced at all. Through this mistake the whole scheme failed. A rapid run to Diu was followed by a two months' siege and bombardment of the Portuguese position by land and sea; but Mascarenhas, the valiant commander, kept the flag flying in spite of terrible losses, till the autumn change of monsoon brought rumour of a relieving fleet, which was too much for the Turkish admiral. Whether he had been definitely ordered to avoid action by sea under all circumstances, or whether his own cowardice was to blame, will never be known, but the sight of three strange sails on the horizon drove him to retreat in such haste that he left many of his men and guns on shore. Turkish historians relate that he retired before a vast armada, but in actual fact the strange sails were only three small reconnoitring caravels, unsupported by any fleet within 800 miles.

Unfortunately for the Portuguese this poltroonery made

them too confident of their power to keep the Turks in check, and even when the successful relief of Malacca released ships for other duties the divisions thenceforward based on Ormuz and Aden remained almost negligible in quantity. Soliman discovered this in course of time, and, though he had no intention of trying his fortunes in India again, planned an attack on the Portuguese fortresses at Ormuz and Muscat, which were quite close to his own bases in the Persian Gulf, and towards the end of summer held large stocks of valuable freight awaiting removal on the winter monsoon. But before this he had employed his Suez fleet in reducing the Arabs all round the Red Sea to subjection under a new admiral, the celebrated Piri Reis; and at the same time had built a second fleet of galleys at Busrah, at the head of the Persian Gulf. Being now in a much stronger position, therefore, than when he assayed to capture Diu, he undertook another expedition in 1546, in which his new Persian Gulf fleet was intended to sack Ormuz and Muscat.

Unfortunately for Soliman his admiral went the wrong way to work Sound strategy would have dictated an attack on the very small Portuguese division first, whereby one or two ships of a useful type might in all probability have been captured. But so intent was he on loot that he passed these vessels by night—which were at anchor off Ormuz quite unaware of any Turkish advance—and made straight for Muscat. There he met with disaster through the fire of the Portuguese artillery, which reduced him to so shattered a condition that he straggled homeward to Busrah without attacking either Ormuz or the Portuguese ships at all. Had the latter been aware of what was happening so near at hand they might have converted the Turkish retirement into a rout.

This reverse exasperated Soliman, who had no mind to let it be final, and as a form of immediate retaliation turned his attention to the handful of Portuguese vessels and the small shore depôt at Aden. The conquests of western Arabia by Piri Reis had earned for the Turks the bitter enmity of the Arabs, and the original hostility of the latter to Europeans had been proportionately abated. One outcome of this reversal of attitude

had appeared in the form of an approach by the formerly inimical Sheikh of Aden to the Portuguese, with a request for help. This was promised on the condition that he paid an annual tribute to the Crown of Portugal and allowed the Portuguese to make full use of Aden as a commercial centre and squadron base of supply. For sixteen years this mutual obligation had remained in force, and proved effective in preventing Turkish aggression; but the volume of trade had been too thin to induce the Portuguese to spend money on erecting special shore defences for their warehouse as at other places, and the naval protection had been reduced to a minimum. Consequently, when, the year after the Turkish defeat at Muscat, a fleet of eighty war galleys under Piri Reis suddenly appeared off Aden at daybreak, the three Portuguese vessels in the harbour hastily embarked the agency staff and fled, leaving the unfortunate Moslem sheikh to pay a terrible penalty for his alliance with a Christian Power. Thenceforward Aden was lost for ever to Portugal alike as a vassal state, a trading exchange, and a naval base. By a great effort the Portuguese might perhaps have driven the Turks out again, but the results would have been out of all proportion to the expenditure of force where the commercial profits were so small, and their expulsion from that quarter was the first permanent curtailment of their scope of dominion in eastern seas.

This misfortune, together with the narrow escape of Muscat and Ormuz, now compelled the Portuguese to realise that some rearrangement of their defensive units was necessary if they meant to keep any hold on the north-western entrances to the Indian Ocean. It was impossible to foresee any limit to Turkish schemes of extension while Soliman remained alive, or to predict the scale of his naval activities; and whereas everything had been subordinated so far to a firm hold on the Straits of Malacca, a revised appreciation of their general position led them to a shifting of their balance of forces across a space of nearly 4000 miles, whereby the Malacca end was lightened in favour of the Persian Gulf, at first only in a minor degree, but by increasing instalments with the march of events. Ultimately the process was carried too far.

The abandonment of Aden set free a small squadron which was applied as a first augmentation of the straits of Ormuz division. Further additions were then made by drawing on Malacca, and for six years the increase answered its purpose although Soliman still had predatory intentions on Ormuz and Muscat. In part his ambitions in that direction were held in check also through calls on his finances to meet his commitments in Europe, which delayed progress with his shipbuilding projects in eastern waters. But by 1552 these were completed, whereby a considerable number of galleys were added to his fleets in the Gulf and Red Sea; and the experience of wars in the Mediterranean had taught the Turks the importance of concentration. Being now ready for a second dash he ordered Piri Reis to run the Red Sea fleet up before the summer monsoon to the vicinity of Muscat and there join the Persian Gulf division from Busrah, taking care to avoid the Portuguese till the junction had been effected, and then attack *first* their ships and *afterwards* their positions on land. It was a scientifically conceived scheme, and well carried out up to a point. Effecting his combination as pre-arranged, the Turkish admiral fell on the Portuguese squadron and put it to flight, then in overwhelming force bombarded and took Muscat, sacked the warehouses, blew up the magazines, disarmed the citadel and sailed away with the survivors of the garrison as prisoners, having no intention of retaining his capture. He next passed on without delay to Ormuz, where he besieged the citadel by land and sea for a month, but without success, and, fearing the appearance of a relieving fleet with the change of monsoon at a time when he was getting short of munitions and supplies, he abandoned further operations and retired to Aden.

This attack was a serious matter for the Portuguese, even though Ormuz had withstood it. Not only had they lost a whole season's goods and a number of comrades-in-arms—whose lot as galley slaves in the Red Sea was the most miserable fate that could befall a white man—but a blow had been struck at their prestige in native eyes which might have affected their whole position in the east. At Aden their retreat had been unavoidable in face of a hopelessly superior adversary as regards

numbers, and even if the incident had not done them any good, it did not actually lower their reputation in arms. But at Muscat they had been squarely defeated in both elements, and for the first time a Portuguese flag had been hauled down and trampled on. Knowing that this would soon be the talk of every port on the south coast of Asia, and that only immediate action would save their credit in the eastern mind, they lost no time in re-hoisting the flag at Muscat and re-arming and garrisoning the citadel. And to make quite certain that, as far as their resources would permit, the Turks should not approach in future, they again increased their squadron in the Straits of Ormuz at the expense of the Malacca division.

These steps answered their purpose in so far as the immediate safety of their position at the entrance to the Persian Gulf was concerned, which the Turks made no attempt to threaten for nearly another generation. But in truth the whole Portuguese position in the east from the Cape of Good Hope to China was only saved from extinction in the century of its pre-eminence because the Turks were incapable as a nation of rising to oceanic opportunities. Had they felt the trading impulse which drove the North Atlantic peoples to undertake some of the most hazardous feats in the history of the sea they might have thrust the Portuguese out of the Indian Ocean altogether, and diverted the westward flow of wealth back from the Cape route to its old channel across regions now in their own hands. As a very powerful military nation firmly planted on the brink of the Indian Ocean, in a position of supreme strategic advantage, everything in its waters was theirs for the display of a little enterprise. No scruples deterred them, and during this same period they made rapid progress in the art of naval war through their experiences in the Mediterranean. But being constitutionally averse to standing on wet decks, unless urged by the sight of plunder within easy reach—as in the Levant and Black Sea—they never summoned the resolution to head out for blue water, and except for a few snatches at points close to hand, halted and looked on with envy while a handful of representatives from a diminutive European State came half round the globe to gather up the immense riches of a hemisphere right under their eyes. And therefore, though

constantly desirous of demolishing the Portuguese supremacy of the eastern seas—with all which that implied—they only succeeded in fraying its edges.

Meanwhile the Portuguese trade continued steadily to expand from India and the Malay Islands all through the middle part of the sixteenth century, reaching its highest volume towards the end of the third quarter, during an interval of twenty years of peace on all sides following the second attack on Muscat. But this prosperity was gradually exciting the cupidity of the new generation of rulers in the Malay States, who had not been born at the time of the earlier attacks on Malacca, and were disposed to believe that they might have managed them better. A long period of cessation from strife had done much to lessen the respect in which the Portuguese squadron in the Straits of Malacca had been held by their fathers and grandfathers; and their own flotillas were not only much larger than those of their predecessors, but were now partly armed on the European galley model, with guns in the bows. The pendulum of war, therefore, which had swung westward during the reign of Soliman, began to swing back across the Indian Ocean. The Malacca division had been maintained on a reduced scale ever since the Turkish raid on Muscat, which was undoubtedly a contributory factor in the situation; and the second series of attacks began in 1572 on that end of the line, and for four years in succession occupied all the energies of the Portuguese during the winter monsoons in meeting them.

With each return of autumn during that period, one or other of the Malay princes launched a formidable armament against Malacca. The first two attempts were made by the King of Acheen, but were met on the water and frustrated by the crushing defeat of his fleet, which left him impotent for a brief spell. For the time these reverses were enough to keep him at home when the next season arrived, but the Portuguese committed the serious error of supposing that such a lesson would be taken to heart by the other Malay rulers, and made no effort in consequence to strengthen their local squadron. For this mistake they paid. The King of Java was anxious to

try his fortune when the Achinese stood aside, and in the autumn following their second failure he arrived in the Straits with 300 well-armed vessels full of troops. Before this great display of force the Portuguese squadron was compelled to retreat to open water, and the way being thus cleared their enemy's army disembarked to attack the town. With a view to hastening its capture, the Javanese fleet pushed its way up the river, but like most of the streams in southern Asia, this river fell in volume at this season, and before the stockade on the banks had been broken through, the proas were all hard aground for the winter. Intelligence of this state of affairs somehow reached the officer commanding the Portuguese squadron—which after evading action by superior sailing qualities remained hovering in the offing—and gave him a chance for effective intervention. Promptly covering the sea approaches to the harbour, he managed to intercept the food supplies for the besieging army which were coming in unarmed trading craft, with demoralising consequences to the Javanese. The besiegers became blockaded themselves, and between starvation in camp and repulse at the ramparts, perished in such numbers that when their grounded fleet was refloated with the spring rise of the river, so small a remnant survived that they raised the siege and re-embarked for home in time to escape the outcoming Portuguese fleet due with the advent of the summer monsoon. It would appear that even so they were strong enough to deter their enemy's squadron on the spot from molesting their retirement.

In this way ended the third of this series of attempts to take Malacca, and so sure now were the Portuguese that it would be the last, that they even reduced the local squadron to three ships. But the Achinese had had a breathing space for a year, and emboldened by the weakness of the force confronting them struck once more. Collecting a hundred proas they embarked an army and advanced for the third time. On this occasion naval success awaited them, for the small Malacca division was caught and totally destroyed, probably on account of light winds. The army was then landed to make one final effort to capture the town, but failed, as on every previous attempt; for so determined was the defence that it held out till the next year's fleet was due and the Malays abandoned the enterprise.

The second series of attempts to capture Malacca now came to a conclusion, and more than half a century was to elapse before it was again threatened by an Asiatic enemy. Its defence had been an epic of stubborn courage. For two generations of Portuguese officers this centre of commerce had been the chief post of honour and danger in the service of their country, but in spite of seven attacks the flag had remained flying; and it was reserved for a European hand to haul it down when the time came at last, thirty-seven years later. Repeated failure to plunder the Portuguese cargo storehouses finally disheartened the Malays altogether—for this had always been their chief temptation—and as it appeared to their fatalistic eastern temperament that the decree of fate doomed all such ambitions to disappointment, they left the white man in peace. But the Portuguese had been badly shaken, and decided after the last Achinese attempt that if the Straits were worth holding at all they were worth holding effectively. Two successive seasons had seen all trade at a standstill, and nothing but adequate naval protection could absolutely guarantee them against this happening again. It was resolved once more, therefore, that Malacca should have the first claim on their winter dispositions, next to their ports in India itself, and that Ormuz and Muscat must take their chance, as being commercially less important.

Five years passed without incident, and then in 1580 the Turkish menace flared up momentarily for the last time. Twenty-eight years had elapsed since their loot of Muscat, and after that experience the Portuguese Ormuz division had been strengthened. But it had been again reduced to meet requirements in the Straits of Malacca, and after waiting for a period to see if the reduction was permanent, the Turks took advantage for the third time of Portuguese naval weakness at the Persian Gulf entrance, to make a rush on Muscat, which for the second time they sacked, carrying off plunder and prisoners, although on this occasion they made no attempt to molest Ormuz. This was the last appearance of the Ottoman as a figure of any consequence in the episodes of Indian Ocean history, even though for 335 years more the empire of the Sultans extended to its shores.

The sixteenth century was by this time well into its last

quarter, but before it came to a close the Portuguese experienced some trouble in a fresh direction. In 1587, after Ceylon had by the voluntary action of its rulers remained for eighty years a vassal state of Portugal, King Singa repudiated the treaty of his predecessors and attacked the Portuguese station at Colombo It held out and was soon relieved by a fleet from Goa, but the movement spread, involving the Portuguese in the nearest approach to field operations at a distance from a sea base that they were ever called upon to undertake in the east; and although these were successful the Viceroy deemed it advisable to fortify their Cingalese coast depôts at Trincomalee and Baticaloa as well as Colombo. In 1598 they were also compelled to deal with a Hindoo chief who had boldly resorted to piracy on a large scale from a small harbour on the Malabar coast itself, and for a winter monsoon season attacked Christians, Mahomedans or Hindoos impartially as occasion arose. In stamping out this common enemy the Portuguese admiral was ably assisted on the land side by the Hindoo King of Calicut.

But these were comparatively minor occurrences A far more serious and unfortunate event for the Portuguese at this period was the union of their country in 1580 with the kingdom of Spain under Philip II, by which they were dragged into his prolonged and disastrous wars in Europe. So great was the share they were compelled to pay in the expenses of his campaigns that their treasury was practically depleted, and they had no means left for financing their eastern trade. During the last decade of the century their imports declined very rapidly in consequence, their Asiatic depôts became all but empty and their ships having nothing to carry almost disappeared from the sea, except a few stationed at various points for defensive purposes. All this depression of trade, however, might possibly have passed away with the return of peace in Europe, or the recovered independence of Portugal which took place later, had it not been for the fatal blow to Portuguese prosperity dealt by the ordinance of Philip II which prohibited any sales in Lisbon to merchants or dealers from Protestant countries. Being unable after this to get the pepper and spices which they had obtained regularly from the Lisbon official market for more

than a hundred years, other nations' seamen set out to get these things for themselves in the lands of their origin and when that movement began the fate of the Portuguese commercial and strategic dominion of the Indian Ocean was sealed. It was not so much that they lacked the ships to uphold it—at first at any rate—but that they lacked the right sort of man behind the gun. Albuquerque's scheme of intermarriage between the earlier Portuguese forces and native women, in order to provide seamen and soldiers for the future without drawing on the population of the mother country, had been carried so far in three successive generations from its original inception, that by the beginning of the seventeenth century the fleets and forts under the Portuguese flag in the east were manned by locally-raised recruits with scarcely a streak of European in them. When led by European officers they were able to deal with such enemies as Malays and Arabs, or even Turks. But racial superiority is quite as much dependent on the female as on the male element and the rule of oceanic areas is too great a prize to remain in the hands of a mixed breed. When therefore these descendants of Hindoo mothers and grandmothers were pitted against ships with Dutch and English crews—full-blooded Europeans and the finest seamen in the world—their defeat was a foregone conclusion. Before the birth of the new century the first Dutch keels had already rounded the Cape, and within another fifty years the great fabric of Portuguese maritime sovereignty in the east had been shattered for ever.

For Portugal, however, the sixteenth century was a period of such remarkable renown as seldom falls to the lot of a small nation; spread over a geographical area unrivalled in extent in the annals of any small nation but Holland, and richly earned by gallant exploit and strenuous labour, even when marred by excesses and avarice. The great place once held by the Portuguese on the sea has long since vanished, but nothing can take away their great place in history as the bearers of the first European flag ever seen in longitudes east of the African continent since the days of Alexander, 1800 years before those of Vasco da Gama.

VIII

The ARRIVAL of the DUTCH and BRITISH in the INDIAN OCEAN

No short war ever waged in human records produced an effect on the subsequent history of so great a portion of the surface of the globe as the defeat of the Spanish Armada in 1588. For generations prior to that cataclysm the Iberian peoples had been so supreme on the sea that they dominated all the oceans of the world, and in virtue of that power exercised an appreciable influence in all the continents. In America they were lords of the soil as far as the European had penetrated from the coastline. In Asia and Africa—outside the shores of the Mediterranean—they were the only representatives of the white race known to the natives by actual contact and presence. In Europe the military resources of the Spanish ruling house threatened the independence of every Protestant nation, and the naval supremacy of Spain compelled all the western States, whether Protestant or otherwise, to pay extortionate prices for the products of trans-oceanic countries. No rivals could hope to found oversea colonies while the obstacle of the Spanish fleet stood in the way, and still less could they hope to engage in traffic with oversea countries. All Europe on its Atlantic side was enclosed by the wall of Spanish maritime ascendancy, and if that barrier had lasted to our own time New York would never have been either Dutch or British—and might never have come into existence at all—and India would probably have remained under Asiatic rule unless conquered throughout by the Portuguese.

This sea wall, however, was not destined to stand in permanence, for, led by the Anglo-Saxons, the virile northern branches of the white race, always impatient of restriction in any form, broke it down and poured across its wreck to the four quarters of the globe. To quote the words of Froude, in reference to the English, "within the space of a single ordinary life these insignificant islanders had struck the sceptre from the Spaniard's grasp and placed the ocean crown on the brow of their own sovereign." But if it was the English who were

mainly instrumental in overthrowing this formidable obstacle to free sailing, it was the Dutch who were the first to follow up in some directions the long roads thus cleared to the far regions of the world. And having followed them they tried in their turn to close those of the more important once more against rivals; though never accomplishing so wide or effective exclusion as the Spaniards in their national prime.

While Spain remained all-powerful by land and sea Portugal benefited indirectly, as long as she kept on good terms with the succession of autocrats at Madrid, whose territory shielded her against the approach of any other possible enemy by land, and whose fleets made the Atlantic too dangerous for vessels under other flags to navigate; although by a pact arising from the Papal decree which divided the oceans of the world between Spain and Portugal, the Spaniards abstained from interfering with the Portuguese traders as long as they only sailed for eastern destinations. But when the Armada had been destroyed, the Atlantic became comparatively secure for any vessel that could hold her own against ordinary pirates, and the route to India lay across that ocean in its first lap, as well as the route to Mexico or Peru. Thus the defeat of the Grand Fleet of Spain was the initial step of a series of developments which led to a change in the command of the Indian Ocean as well as of the seas of the western hemisphere; and of these two changes the first-mentioned was much the more rapid in its process. Before the last vestige of Spain's naval power in the west was to disappear a full two centuries were yet to elapse, but less than fifty years sufficed to sweep the Portuguese dominion of Asiatic waters clean out of existence, and leave a remnant of greatness trembling on the defensive before a relentless adversary. The sixteenth century had witnessed Portugal's power and prosperity beyond the Cape of Good Hope reach its culminating point, but before the seventeenth had run half its course, that power had vanished as completely as the pre-eminence of the Arabian seamen whom the Portuguese admirals had driven from the same seas in the reign of King Manoel I.

This passing of a maritime rule had a double aspect. It was a forcible supersession of Latins by Nordics, and of a State

organisation by private enterprise. By natural aptitude the northern nations of Europe were better men on the deck of a ship than any others, whether engaged in the affairs of peace or war: the Dutch being perhaps the best of all at that time. A relative poverty, however, had compelled them so far to do their best with very inferior material, and the vastly greater wealth of Spain and Portugal had provided the Iberian seafarers with much more formidable fleets and armaments. Not until the Armada had been reduced to planks and driftwood did the inequality in equipment between the Iberians and their northern opponents sufficiently disappear to give the English and Dutch an opportunity to prove their inborn fitness for sea life; of which they soon took full advantage in every direction of the compass.

The second aspect of the change lay in the character of the administering authority under which the new era of maritime supremacy in the east came into existence. In the Portuguese cycle of domination the whole organisation of power in the Indian Ocean remained a government responsibility down to its smallest detail; but with their successors it passed to the hands of privately promoted associations, whose aims were officially sanctioned by express charter, but whose actions and methods of operation were in practice free from government control. Three such corporations sprang up, one English, one Dutch and one French; but the last named played a very minor part in eastern maritime affairs during the seventeenth century as compared with the other two, and had no share worth mentioning in the overthrow of the Portuguese command of the eastern seas. Though established—ostensibly at least—for the purposes of trade only, these syndicates controlled a respectable fighting force, from the very nature of their work. For in those days of lawlessness on the high seas every vessel employed in oceanic transport had to carry her own means of defence; and as the distinction in design of the fighting from the trading ship had not yet appeared in vessels built for distant voyages, all hulls of oceanic tonnage were constructed to mount a battery as well as stow a cargo.

Hence when these commercial adventurers set their faces

eastward they were fully equipped for war on the sea if necessary, and their respective states found it not merely convenient to leave them to protect their own interests when threatened by foreign opposition, but even to use them as means for extending national prestige. Authority was inserted in their charters therefore to engage in distant theatres of war, not only against local native potentates and rival companies, but also against the national forces of hostile European Powers; and so extensively did they avail themselves of this right to undertake naval and military operations that in time they became important factors in international affairs, while in eastern waters the position of supremacy to which they attained within little more than a generation, in spite of constant quarrelling among themselves, was sufficient to overawe the whole coasts of southern Asia and the Malay Archipelago.

An entirely novel situation arose in eastern history in consequence, for now the Indian Ocean—the scene of so long and varied a record of maritime incident—passed from under the dominion of a Crown to that of groups of sober men of business, seated in offices at a distance of a ten months' voyage. And although few of these had ever sailed a ship or handled a weapon in their lives, their influence on the course of oriental events thenceforward for a long period was greater than even that of the Mogul Emperors on the Peacock throne, or the "Sons of Heaven" in the Great Hall of Audience at Pekin, or the Kings of Persia in the Courts of Ispahan. Remarkable and complete though it was, however, and vigorous while it lasted, this reign of unofficial power was not destined to remain permanent. As a temporary delegation of great national interests on the sea to private hands in three countries it was a success, but in the sequel it proved to be a preparation only for fuller developments on State lines, and the command of the Indian Ocean had again reverted mainly to fleets under national ownership, in the great struggles for its tenure that took place in the century following.

Private European enterprise in eastern waters had its origin in some small Dutch ventures towards the end of the sixteenth century, which were the direct outcome of the interdict of

Philip II against any transactions in the Lisbon market with Protestants. From very minor beginnings the Hollanders succeeded within a few years in establishing a pepper market of their own, where at first they numbered the British among the customers who were barred from Lisbon by the same decree. But the English themselves were looking towards the east, and as the Dutch vendors made the mistake of demanding exorbitant prices without any such security against competition as the Portuguese had enjoyed in the days before the decline of Spanish sea power, the London business community resolved to procure pepper at its native source on their own account. To that end, and also to avoid undue rivalry among themselves, they amalgamated in 1600 to form the company of "London Merchants trading to the East Indies," under a charter signed by Elizabeth. Next year their pioneer squadron sailed on the first of a long and highly profitable series of annual voyages.

Meanwhile the Dutch were feeling the disadvantages of competing against each other, and to obviate this followed the English example of combination to float a similar trading syndicate in 1602, on a much larger and more powerful scale. Seeing these movements in progress the French came next with the formation of a third such corporation in 1604, although in their case on less ambitious lines than the others. Thus three companies were in the field in a very short period, whose respective policies and methods of operation afford an interesting contrast, for though all were founded on a professedly mercantile basis, their pursuit of business was conducted under widely different ideals and systems.

By far the most important position in this great expansion of European intercourse with Asia was held in the earlier stages by the Dutch. Energetic, aggressive, soundly conceived from the strategic standpoint and skilfully carried out, the policy which received its direction at Amsterdam displayed all the teutonic characteristics of thoroughness, foresight and capacity. Trade in Dutch hands was not merely defended by force of arms but pushed by force of arms scientifically and resolutely applied. To obtain the products of any region which they had marked out as an area of prospective enterprise, they

began by conquering and annexing the land itself, as far as that lay within the capability of their somewhat limited military forces; but, if territorial conquest was beyond their powers, they applied their naval strength to kill rival trade in the coveted field, by a series of relentless, patient and effective blockades, enforced for any number of years that might be necessary to attain their object.

Having about eight times as much capital as the London Company and about four times as many ships, nothing indeed set any limit to their activities on the coasts of the wealth-producing regions of the east except the fear of vigorous counter-measures directed against their mother country by such of their injured or protesting rivals as might be strong enough to take them; and no treaties of peace between the States General —or national governing body of Holland—and other rulers or governments in Europe were treated by the Company's officials in the Indian Ocean as worth observing on the far side of the Cape of Good Hope if they could be ignored without serious danger, which was always possible where Portugal was concerned after the Dutch navy had thoroughly destroyed that of Spain in European waters in 1607, five years from the date of the Company's birth. Portuguese trade was incessantly subjected to their forcible interference in consequence, and for half a century a ceaseless antagonism existed in Asiatic waters between the seamen of the Portuguese Crown on the one hand and those of the Dutch merchants on the other, in which the former were everywhere worsted in the end. Of the English the Hollanders were equally jealous, and when the period arrived in which they could no longer count on English goodwill in their long drawn out hostilities with Spain, the Dutch officers in the far east showed little hesitation in resorting to violence when local disputes with the English arose. But with the further passage of time they were compelled to modify their attitude by Britain's advance to the rank of a first-class naval Power, holding a position across the home end of a route connecting Holland itself with all the Company's distant possessions. Towards the French they displayed more restraint, partly because they feared Bourbon military pressure on the

mother country's land frontiers—in which respect Holland shared none of the security of Portugal, as a small country completely screened on the land side by a powerful and well-disposed neighbour—and partly because for a long time the French Company confined its attention to Madagascar, in which the Dutch took little interest.

In every point of importance the methods and procedure of the London Company offered a marked contrast to those of their rivals, for quite the first hundred years. No such idea as a British rule of the Indian Ocean, or still less a British rule of India, ever entered the imagination of its governing body for generations after it was floated Entertaining, therefore, no ambitious schemes for securing a monopoly of eastern commerce, and working on no pre-arranged plan of expansion, they refrained in general from attacking competitors who made no attempt to thwart their business and movements by open violence; and beyond insisting on a share in Asiatic trade, their whole policy was haphazard and opportunist towards the political problems bulking larger year by year from the presence of several European flags in eastern seas. Except when exposed to persistently serious opposition, they maintained in the east an attitude towards the Europeans which was in accordance with the relationships of the mother countries towards each other at the moment. That is to say, if the mother countries were at war, the British Company treated all representatives of the enemy State in the east as adversaries in arms, legitimately subject to attack, but when the mother countries were at peace they abstained from violence towards these representatives, so long as the latter on their part remained peaceable also. In the matter of the proper observance of treaties made between nations in Europe, the Portuguese historians are very favourable in their comments on the rectitude of the London Company, as compared with their rivals at Amsterdam. But while making no bid for maritime empire on that side of the globe, the London merchants uncompromisingly refused to acknowledge the right of any third party to intermeddle in their intercourse with independent native rulers.

For a century after the foundation of the first French Com-

pany this body and the succession of similar syndicates which arose after its early liquidation and were dissolved themselves in turn, occupied a position of marked inferiority to the Dutch and English, and exercised little influence on the course of Indian Ocean history. But in these earlier stages they were left undisturbed by the Dutch for the reasons already given, by the Portuguese because the latter were being desperately harassed themselves, and by the English because at that period the French activities did not cut across their own.

Such were the aims and such the methods of the three private mercantile syndicates whose sails were now to be seen from many of the capes and beaches of Asia. Through a long series of warlike operations spread in a disconnected fashion over a vast area, and conducted at intervals for more than half a century—some of which had a military as well as a naval side, though all were necessarily based on the naval situation of the moment—the appearance of these ships heralded the turning of a page of Indian Ocean history. In the era which followed, the dominion of its surface was still to remain absolutely in the hands of the white man; but instead of being the monopoly of one European flag it was to become first a rule shared by three and then by two: not under any expressed understanding or spirit of co-operation, but simply because at first none of the three was strong enough to throw the other two out, and later, when one of them did possess that power, it was held back by the compelling influence of certain events on the other side of the world.

The very early Dutch trading voyages, which were the germ of this great change, were made by individual adventurers before the creation of a wealthy and powerful Company, and their small scale rendered it prudent for them to avoid the northern shores of the Indian Ocean where the Portuguese power was chiefly centred. But a promising alternative quarter lay in the centre and remoter parts of the Malay Archipelago, where highly valuable spices of many kinds grew in plenty, and Portuguese opposition was less to be feared owing to the distance from Goa and the weakness of their outposts. In that direction they steered accordingly and, thenceforward, the

general region which became the specially Dutch area of enterprise lay on the eastern or Malay side of the Indian Ocean, as contrasted with the northern or specially Portuguese side, though each had at some period outposts lying in the sphere of the other. And if the Dutch region was thus to some extent selected from purely commercial and political reasons at the beginning, its subsequent retention was due in part at least to a shrewd appreciation of the strategic value of a windward position. For it so happens that the southern parts of the Archipelago are situated in the zone of perpetual south-east trade winds, and a fleet lying there is to windward of the whole Indian Ocean throughout the year; on any part of which it can make a descent with the minimum of delay or difficulty inherent in navigation under sail. Even when the south-west monsoon is blowing in the northern latitudes of that ocean, a fleet starting from southern Malaysia had only to run far enough westward in the trade wind to get the great advantage of the weather gauge of any enemy in the monsoon area. Thus from the very outset of their half century of conflict with the Portuguese the initiative was always in Dutch hands.

As soon as the individual traders had merged in one large association and fairly organised their resources, a first voyage was despatched, in which fourteen ships took part under Admiral van Warwyck. Such a fleet was amply strong enough to make for India as far as the Portuguese could do anything to prevent it, but the Company had decided to begin their business by following up the contact already established with the Malay islands by the pioneer voyages of their countrymen, and it was to the archipelago that Warwyck sailed accordingly. Next year thirteen more ships started under van der Hagen, but this time India was their first destination. It was not as yet any part of the Dutch intentions to acquire trading factories or ports ashore in Hindustan, for their troops were still too few to garrison such positions, and their proximity to the Portuguese headquarters at Goa rendered strong garrisons necessary if ships were to be free for trading purposes. But they were determined to anchor in Calicut roads and assert a right to enter into any commercial dealings with the natives outside the

Portuguese settlement; and here van der Hagen's arrival in due course excited great alarm at the Portuguese factory and great surprise among the Hindoos. As between the Dutch newcomers and the long established Portuguese colony the local Native Prince was in a like embarrassment to his ancestor of a hundred years before between the then newly arrived Portuguese and the Red Sea merchants. He was anxious not to sacrifice the goodwill of a rich trading element of long standing on the spot by dealing with their competitors, but found the latter advertising their presence and pressing their claims to his favour with a stronger fleet than had ever been visible from his palace roof before; and being afraid of the possible consequences of rejecting their advances agreed to sign a treaty of commerce. In actual practice the Dutch made very little use of Calicut for many years thereafter, but the action taken had a sensational political importance as a widely proclaimed announcement to the trading classes of India and their rulers that henceforth the Portuguese factories would not be the only markets in which their goods would find a sale. And it taught them also that the Portuguese were not so omnipotent on the water as the east had long believed. With the treaty in his pocket the Dutch admiral tripped his anchors and sailed on to the Archipelago through the Straits of Malacca, keeping outside the range of the guns on Malacca sea citadel, in perfect safety and without any difficulty in navigation, although some writers have called it the "key" of the eastern gateway to the Indian Ocean, in the misleading fashion in which Gibraltar has as often been called the key to the Mediterranean. Following on van der Hagen came a regular succession of annual voyages continued for generations, but for a good many years these left India unvisited and the squadrons employed stood right across the Indian Ocean to Malaysia. And as each arrival usually took place shortly before the homeward bound departure of the squadron immediately preceding it, the Dutch were in a permanently strong naval position in the far east almost from the first, save for the want of a good naval base.

Meanwhile the Londoners had also been pushing ahead on

their own minor scale, but under serious handicaps, for the peace-loving King James had strictly cautioned their officers that though they might defend themselves by arms if attacked, they were to avoid exciting trouble by overstepping Portuguese claims; which left them little option but to keep clear of the northern parts of the Indian Ocean altogether and stand across to the east, though on that side the powerful Dutch squadrons were already laying hands on almost every trading market worth having. A long series of heated disputes arose in connection with that area between the rival companies in consequence, conducted by conference and argument in Europe and not unfrequently by blows in the far eastern tropics; but for the first few years the anxiety of the Dutch nation to retain the support of England in their struggles with Spain at home kept their Company from extreme measures, and the English managed to establish several trading ports in the islands, the chief of which was at the Javanese port of Bantam, just inside the Straits of Sunda. But not one of the London Company's settlements or factories was fortified, and a time came in which, through the defeat of their ships, they were eventually driven out of the Archipelago altogether, and very nearly out of the whole eastern seas.

Thus an entirely new situation was arising in the Indian Ocean whereby a complete transfer of its supremacy to fresh hands was commencing. As long as no possible enemies but Asiatics had to be reckoned with the general strategic position of the Portuguese in the east was always simple and clearly defined, for if the true outlook of a frontier is away from the metropolitan base and centre of government, their Asiatic frontier faced landward and was formed by the coast lines of the Indian Ocean, on the sea side of which their power was absolute and their home communications lay, while on the land side their power was small, in spite of a few strips and patches of territory touching the water. Being unassailable by Asiatics on the Ocean—except for a time by the Turks—their rear was free from all danger, and their touch with Europe so secure that their fabric of Imperialism in the orient was never left to stand uncertain of the support of the mother country.

All this was now inverted. Once the vessels of other European Powers could sail eastward without fear of the Spaniards the oceanic communications of Portugal ceased to be immune from molestation; and with the prop of the mother country thereby knocked away—or at best made unreliable—all Portuguese national life on the far side of the globe was left to exist as best it might, on its own local resources. Instead of facing inland in all matters of defence and diplomacy, the Portuguese garrisons and communities in the east were now compelled by degrees to turn right round and face the sea, looking towards their former rear. The trade which had been the original incentive of their long search and eventual doubling of the "Cape of Storms," was now threatened with a competition certain to diminish profits and possibly extinguish them altogether, but that could not be prevented. A possibility remained, however, that their possessions on the land, such as they were, might remain under the flag, for even if left to shift for themselves and turned strategically upside down, they were not altogether without some means of self support. As a result of a century of ownership a generation of Portuguese colonists had taken permanent root in the more important of their Asiatic settlements, from whom—together with a large half-caste and native community—the *personnel* of local defensive forces could be raised; so that although reinforcements could rarely be expected from home in the event of trouble with Holland or Britain, garrisons of a sort could still be maintained at such points as Goa, Malacca, Colombo and Ormuz, poor in quality, but strong enough in numbers to cause an attacking enemy considerable trouble. Moreover, as regards weapons, the native armourers working under Portuguese engineers could now turn out ordnance, equipment and ammunition little if at all inferior in quality and model to the simple patterns produced at that period in the arsenals and dockyards of Europe. Money was a difficulty, but even here the Portuguese Indian authorities were not without expedients.

When the command of the Indian Ocean passed out of their hands, therefore, the strategic position of the three Viceregencies, into which the organisation of Portuguese authority in the

east had been divided before the end of the sixteenth century, became gradually similar in all essentials to that of native Asiatic States when confronted by the forces of a European Power such as Britain or Holland. Though not without local resources their downfall was certain, sooner or later, unless these resources sufficed for all defensive purposes without aid from Lisbon. Not that this condition reached an extreme form immediately, however, or even without lapses and difficulties for their adversaries; for even if at the commencement of the seventeenth century Portuguese fleets were no longer able to exclude all other flags from the Indian Ocean, a period of quite twenty years had still to pass before their own freedom of movement had become so greatly restricted that they could no longer carry succour to a beleaguered garrison.

The first twenty years of the new century, therefore, were marked by a stage of contending but approximately balanced naval pressures, in which Portuguese, Dutch and English were all able to hold a general position in the east without being powerful enough to encroach on each other's spheres, except at their fringes. Even the Dutch, whose fleets were far the strongest, failed in their attempts to wage offensive war on a major scale, and only succeeded in annexing remote Portuguese trading points in the Moluccas and their neighbourhood. For Portugal this period was the pause of high water which precedes the ebb tide of prosperity, and the final act in which she filled a great place in oriental history. While it lasted her sails were still to be met anywhere between Mozambique and China and all her possessions on or near the coasts of the Asiatic mainland were still under her flag. But the forces destined to reduce her to poverty and insignificance in the east were taking form and direction, some with deliberate aim at her overthrow, and others through totally unforeseen but none the less fatal developments. The Dutch Company during these twenty years were steadily consolidating their hold on Malaysia by seizing and fortifying important points, and by arranging anti-Portuguese alliances with the principal Malay Chiefs. The London Company were adding to their tonnage so as to spread their operations and here and there even acquiring small holdings on

shore in good trading sites, though without defences other than any ships that might be on the spot.

Several collisions marked the tension of this period of unstable equilibrium, in which sometimes one nationality and sometimes another sought to snatch a position or assert a claim at the expense of a rival, but these encounters usually ended in the discomfiture of the antagonists who first drew the sword. By 1607, five years of successful minor attacks on Portuguese property afloat and ashore in the more distant parts of the Archipelago emboldened the Dutch Company to try for something big; especially as in that year their national fleet in Europe was utterly defeating the sea forces of Spain, to which Portugal was then of course united. A blow was attempted at Malacca, therefore, as being a first-class Portuguese commercial and strategic possession, and a strong fleet under Admiral Matalieff was despatched to undertake the eighth attack of this repeatedly assailed but still virgin fortress, in conjunction with a numerous native army, provided by the Sumatran King of Acheen. In the main the story of this attack was simply a repetition of that of five of its seven predecessors: that is to say, firstly, a defeat of the defenders on the sea; secondly, a successful but almost collapsing defence on land; and lastly, a succour at the eleventh hour by a relieving fleet strong enough to recover the local command of the sea. Intelligence of the desperate situation of the garrison reached the Portuguese Viceroy de Castro at Goa in time for him to collect all ships in the ports of Malabar and Ceylon, and hurry eastward on the spring turn of monsoon to fall on Matalieff's fleet off the town, and the Dutch had just time to re-embark their heavy guns landed for siege operations, or it would have gone hard with them. Two severely contested fleet actions ensued, with an interval caused by temporary mutual exhaustion; and after the second the Portuguese so far attained their end that though they suffered much the heavier losses, they left their enemies in no condition to continue the siege. Matalieff therefore withdrew to the Moluccas, leaving his Achinese allies to look after themselves, who were very soon broken up. For eight years thereafter the Dutch left Malacca alone,

though their outward bound fleets arriving in the Archipelago passed through its straits unmolested themselves year after year.

Here we see the Portuguese still strong enough to hold a main position if attacked, but their next engagement with a European enemy in Asiatic seas five years subsequently, proved that the day had passed in which they could control the course of eastern maritime history by enforcing their behests on others. This time their adversaries were Englishmen, and the collision arose from the new direction in which the enterprises of the London Company were moving. Year by year it was becoming more apparent that the attitude of the Dutch in the Archipelago was making English commerce in that quarter increasingly difficult, and though so far no actual armed conflict had arisen, all disputes ended in the Dutch favour; partly because they were the stronger on the spot and therefore impossible to resist by force, and partly because their Company was consistently supported by the government of the nation, whereas the English Company at this stage scarcely received any official support at all. It behoved the London merchants, therefore, to look round for business somewhere else, and in 1610 their group of ships—three in number—outward bound under Middleton, steered for the west side of the Indian Ocean instead of the east, and tried to open up trade with the Turks in the Red Sea. But the Turks proved unfriendly, and Middleton with several of his men were seized when on shore, though by good fortune they contrived to escape from prison and regain their ships, where they were safe enough. Finding no trade opening here, Middleton quitted the Red Sea, ran across to the north-west coast of India before the monsoon, and entered the Gulf of Cambaya to try his luck at Surat. As the Portuguese, however, claimed the whole trade of India, whether in their own ports, such as Goa, or in the ports of independent native kingdoms, they hastily despatched some big galleons from their adjacent sea fortress of Diu to warn Middleton off, and as their appearance alarmed the local native governor, he refused to have any dealings with the English. Middleton departed under protest; but two years later, nevertheless, a pair of outward bound London ships, under Best, made straight for the Surat

coast, determined to assert a right to trade at any point not actually under the Portuguese flag, and anchored in Swally roads. The Portuguese from Diu appeared again—four heavy vessels and a galley flotilla—and ordered him to quit at once. He refused.

Thus it fell to Best's lot to be the first man to decide that Anglo-Saxons were to have a share in making the future history of India. Finding him obdurate, the Portuguese attacked, and Best, accepting battle at odds of something like four to one in weapons and far more in men, saw the matter through to a successful conclusion, repulsing the Portuguese in two engagements separated by a month's interval, not by superior gallantry but by much superior seamanship in making tactical use of the local shoals and tides. It was in 1612, therefore, that the sound of British guns was first heard in India, a prophetic sound indeed, of the full portent of which none of the hearers, or even Best himself, had the faintest notion. It seems almost a matter for regret that the name of the seaman who touched off the first round has never been left on record. Having produced a great sensation among the native officers of the Mogul Emperor on shore, by his successful resistance to the hitherto omnipotent masters of the sea, Best had little difficulty in obtaining four trading sites on the coast, which were the first British footholds in Hindustan.

The enemy, however, though thrown back for the time, were not satisfied that the fight had been properly conducted, and three years later Azevedo, the Viceroy of Goa, assumed command himself of a fleet of nine galleons and numerous small craft, with which he sailed northward and fell on four English ships lying then at Surat under Commodore Downton. For a second time vastly better pilotage work saved the day for the weaker side, and though the Portuguese delivered a succession of furious attacks lasting with intervals over three weeks, the Viceroy—no seaman himself—was decisively outmanœuvred and driven back at every point through Downton's masterly handling of his squadron in intricate soundings, and eventually obliged to retire on Goa with a shattered remnant of his original force.

But the Portuguese were still strong enough on the defensive to score in the very same year one more triumph in holding the possessions acquired by their forefathers as the first Christian conquerors in the far east; and their failure on the shores of India had a momentary compensation in a hard-won success at their eastern gateway to the Indian Ocean. In this year 1615 the Dutch made a second attempt on Malacca, and for the ninth time in its stormy history under the flag of Portugal its assailants attacked in vain. On this occasion, as twice before, the enemy was checked on the water and never reached the stage of operations on the land; for in the inevitable fleet engagement which opened the struggle the Dutch were not so decisively successful as to justify the risk of landing their troops and guns, and the whole enterprise was abandoned. After this second failure to carry amphibious warfare on a large scale to a victorious issue, the Dutch changed their whole methods of dealing with the Portuguese when hostilities between the two broke out again fifteen years later, and ruled any kind of land attacks out of their plans. During these fifteen years Malacca remained undisturbed by any European enemy, and in twice holding it against the redoubtable Dutchmen the Portuguese achieved their only notable victories over European forces in Asiatic regions. Once more, before it was finally lost twenty-six years afterwards, they were called upon to resist the utmost efforts of Asiatic opponents in prodigious numbers at its tenth siege by land or sea or both.

As matters now stood, the Dutch and Portuguese had each suffered twice within eight years by provoking conflict: the Portuguese at the hands of the English, and the Dutch at the hands of the Portuguese. For several years this experience kept the Portuguese from further effort; but the Dutch, foiled in one quarter, turned the more aggressively towards the other outlet for their expansive energy to be found in ousting the English from the Malay Archipelago, which promised a line of less resistance. Obstruction of the work of the London Company's agents in the islands was intensified, therefore; all the more in the knowledge that it would meet with the approval of the Dutch home government; who were no longer able to

JAN PIETERZOON COEN

Dutch Admiral and Governor-General of the Indies Founder of Batavia

(*From* Onze mannen ter Zee in Dicht en Beeld, *by permission of Herr M. Nijhoff*)

count on British support in their antagonism to Spain since King James had taken to cultivating Spanish friendship, and who had no fear of England at that time, as being an inferior naval power to Holland. This obstruction reached its climax under Commodore Jan Coen, the Company's fourth Governor-General. Like the Portuguese, the Dutch made it a practice in the early days of their intercourse with the east, to appoint officers who had held command at sea as their chief executives in their oversea possessions; and in 1618 selected Coen for the post, who became a tower of strength to their interests and a most formidable opponent to all others.

Coen has been likened by some writers to Albuquerque, but the comparison is only permissible in so far as it applies to one side of Albuquerque's character and career. The "Portuguese Mars" was not merely a magnificent schemer in peace but a first rate leader in war, and though Coen was also a competent commander in the presence of an enemy, nothing in his war record proved that he could or would have undertaken Albuquerque's attack on Ormuz against odds of fifty to one, or equalled his conduct of the operations ending in the captures of Muscat, Malacca and Goa. But in his grasp of a far extended maritime situation, his resolute singleness of purpose and his masterful activity, he certainly did resemble King Manoel's celebrated officer. Moreover, he was faced by a much more complicated problem than the Portuguese Admiral, for the latter only had Asiatics to deal with, while his lines of communication were everywhere secure and his freedom of movement by sea consequently absolute. It was no fault of Coen's therefore that he did not enjoy the good fortune of carrying out his own great plans like Albuquerque; for with the means at the disposal of the Dutch these required a whole generation to complete, and he died when their execution was only begun.

When Coen took charge he realised at once—probably he even realised it before—that the most immediately pressing requirement of the Dutch Company was an established eastern capital in a carefully chosen site. For twenty years their ships had been moved about from point to point in the islands, without any definite headquarters, and the need of some

central base had become imperative, as a depot for reserve ammunition and refitting equipment, a commercial focus for the storage and transhipment of freights, and a seat of general administration and intelligence. The position selected had to be alike suitable for the requirements of peace and war, and in fixing it Coen had to take into account the international condition of affairs throughout the whole area of the Indian Ocean. The Dutch frontier of commercial expansion faced eastward, and its chief danger—apart from the state of politics in Europe—lay on its northward or left flank, where the Portuguese were firmly established at a series of posts all along the southern coasts of Asia. Coen's first care, therefore, was to plant the Dutch headquarters where he could meet this danger most effectively, and a very important natural factor in the problem ruled out any site north of the equator. On a previous page the great advantages in sailing days of the weather gauge have already been set forth; and on account of the monsoons a position permanently to windward of the Portuguese could only be found in those parts of the regions of Dutch activity which lay in the trade wind belt below the line. Another requirement for a Dutch capital, in peace or war, was a near exit from the interior of the Archipelago to the open water of the Indian Ocean. Two such openings exist, one being the Straits of Malacca between Sumatra and the mainland, and the other the Straits of Sunda, between Sumatra and Java. The former channel had the attraction for the sailing traders of old days that it offered a good entrance to the Archipelago for half the year as well as a good exit, because approachable during the summer monsoon with the certainty of a fair wind from the open ocean; whereas the Straits of Sunda, being in the southern, instead of the northern tropics, are always difficult of approach on that side under sail, owing to the perennial trade wind. The very same natural factors indeed that made it the best alternative strategically made it the worst from a purely commercial standpoint. Nevertheless it was on this opening and not the other that Coen fixed his eye, and his selection was one of the most interesting moves in Indian Ocean history. Some writers, in searching for his motives, have concluded that they arose from

a desire to establish his headquarters near the Clove islands. Such a consideration may have received his attention, but it was not sufficient to outweigh the navigational advantages of the more northern entrance as mentioned above, and in any case offered no more than a local and minor appeal. The real truth is that this remarkably far-seeing officer took large views, and having constantly in mind the chief menace to the Dutch future in the east, to which reference has just been made, recognised as a trained seaman that the site of the future headquarters should be such as to leave the power of the initiative against the Portuguese always in Dutch hands. A Dutch capital near the Straits of Malacca would lie helplessly to leeward of Goa during the south-west monsoon; a Dutch capital near the Straits of Sunda would be to windward of Goa all the year round.

Very shortly after assuming office as Governor-General, however, Coen's attention was urgently required to deal with the affairs of the present rather than the future, through English rivalry in the Archipelago itself. Most fortunately for him the blunders of one of England's own officers settled this problem definitely in his favour. At the Javanese coast town of Bantam—already mentioned on a former page—which lies near the Straits of Sunda on the eastward or inner side, the chief trading factory of the London Company had been fixed for a good many years. The Dutch also had an agency there and another at the smaller town of Jacatra, which lay to the eastward of Bantam again. Here they were on bad terms with the natives. In 1619, a few months after Coen had taken the helm, he happened to be at the Banda islands with the majority of the Dutch ships engaged in loading spices. But four other of his vessels were receiving cargo at Bantam, together with a squadron of six English under Admiral Dale, an officer more celebrated for dash and vigour than ability. Dale's choleric temper, already affected by malaria, was heated by ever increasing wrangles with the Dutch, till he lost all power of sober judgment in an anxious and critical situation, where a cool head, a clear understanding and sound health were essential to avoid mistakes. Matters were in this condition when the

Javanese chief of Jacatra asked Dale's help to turn the Dutch out of his territory, to which Dale agreed as a retaliation for a series of armed and forcible Dutch interferences with English vessels. As a first step the English admiral attacked and defeated the Dutch ships in the roads and then assisted the natives to capture the Dutch enclosure at Jacatra. But having asserted the policy of the English Company in this fashion, he next proceeded to give his adversary a chance to hit back under every possible advantage, which Coen seized with alacrity. When the Jacatra business was settled Dale dispersed the English ships to embark freights at various points while he himself sailed for India a dying man. It seems impossible to believe that he was aware of the force concentrated near at hand under the Dutch admiral.

News of these proceedings soon reached Coen and in a double sense gave him just the openings he wanted. With all his squadron he hastened first to recapture Jacatra, which exactly answered the requirements of a Dutch headquarters as he saw them, having a good anchorage with a plentiful water supply from a river, in a position conveniently near the Straits of Sunda. On this spot, therefore, by right of conquest, he founded shortly afterwards a Dutch oriental capital under the name of Batavia, which to this day remains one of the most flourishing cities in the east. Having seized Jacatra he proceeded at once in search of the scattered English ships, which were all captured in succession after severe engagements; a round-up inflicting such disaster on the London Company that they were reduced to complete impotence in the Archipelago. Thus both of Coen's most immediate principal objects—that is to say the acquisition of a good site for the future Dutch headquarters and the stamping out of English competition—were obtained through the faulty dispositions of the English admiral.

But in the early seventeenth century the situation in the far east was always ten or twelve months behind the times as regards affairs in Europe—that being the period required for sending out orders from home—and so it came to pass that in this very same year 1619 in which the fleet commanders of the Dutch and English Companies were lashing at each

other in the straits and channels of Malaysia their governing Boards in the mother countries were concluding an agreement for joint action in eastern seas against Portugal and Spain. Before very long this mutual understanding took an aggressive form, which was based on a sound comprehension of the strategic possibilities open to combined effort. Two failures by the Dutch to seize Malacca had proved that the main Portuguese possessions on the land were too strong to be carried by direct assault with the limited military resources of the London and Amsterdam merchants, but on the other hand the ships at their common disposal were sufficient to lay a restraining barrier on the sea trade which gave the enemy's fortresses their real value in the eyes of the Portuguese nation. The Companies proceeded accordingly to test the feasibility of holding this traffic up altogether; not by chasing Portuguese galleons all about the enormous expanses of the Indian Ocean, in which their escape would be easy, but by picketing the very starting point of the homeward route from Goa in sufficient strength to make the capture of any emerging vessel a certainty when once she was beyond the protection of the batteries at the harbour mouth.

This, of course, was simply the form of warfare which has come to be known long since as commercial blockade, but at the time it was a novel method of attacking an enemy's property, for which the only precedent anywhere was Albuquerque's sea closure of Calicut after the Portuguese failure to take that city, early in the sixteenth century. Portugal was now herself to be the first European State in history to experience the commercial blockade of one of her harbours. Its previous non-existence as a principle of war had been due partly to the unimportance of foreign traffic to any country in an age when all were self-contained in the matter of necessaries, and partly to the difficulty of watching a port with sailing ships in bad weather. At Goa, however, the conditions were specially favourable, both to the conduct of the operation and to the effect on the enemy it was likely to produce. Though no longer the channel of so great a stream of homeward bound wealth as it had been fifty years before, the line of communication between the western and

eastern capitals of the Portuguese realm was still a highly sensitive nerve in Portuguese national life; and the complete severance of this line at its outer end was not difficult even for sailing ships, because gales are practically unknown on the Malabar coast except during the south-west or on-shore monsoon, and when that monsoon is blowing the weather itself prevents sailing vessels from getting out of Goa.

It was at the change of monsoon in 1621 that its citizens were first struck with dismay at the sight of approaching British and Dutch squadrons, which presently hove-to in the offing under easy canvas and there remained, for there was no force in the harbour strong enough to drive them away or molest them, and though the garrison stood to arms, it could do nothing. This was to be a common enough spectacle in Goa later, but the raising of the curtain on the first act came as a shock; for even if the Portuguese power of controlling all traffic in the Indian Ocean had passed from their hands already for some years, their own freedom of navigation had not so far been impeded except by sporadic attacks on single vessels, and its wholesale interruption if only for one season was a portent of the worst description. National pride might to some extent be salved by the sight of the flag still flying on the citadel, but colonies which contributed nothing to the wealth of the mother country had little to recommend them at Lisbon, and more than one Viceroy afterwards advocated the total abandonment of Goa and its sister fortresses as mere sources of anxiety and loss to the nation.

Secure in the knowledge that they had nothing to fear, either from the elements or the enemy, the blockaders haunted the approaches to Goa all through the mild Malabar winter, safely beyond range of its land defences; while the Portuguese gunners watched them from the ramparts of Fort Panjim, powerless to strike a blow, and the Portuguese seamen in the few ships inside saw the homeward bound season slipping away month by month in idle exasperation. The moral effect of all this on the native mind was naturally very detrimental to Portuguese prestige, for the peoples of India who came into dealings with them saw that the regular departure of a group of ships for

Lisbon, which had been the chief annual event in Goa for a hundred and ten years, was now being forcibly prevented.

Moreover, the Portuguese were suffering in another quarter simultaneously with the blockade, for the boxing up of a division of their galleons in Goa, even though a comparatively small one, was a sufficient reduction of their sea striking force to give the agents of the English Company at Surat a favourable opportunity to undertake an enterprise already in their mind; not only as a means of extending their business in a new quarter, but as a reprisal for Portuguese interference and intrigues against the Company's interests in general. Two years previously a few English ships had visited Jask, a small port at the entrance to the Persian Gulf, to try and open up communications with the great Shah Abbas and obtain a permit to trade; which move was regarded by Admiral Andrade, commanding the Portuguese squadron stationed in Gulf waters, as an encroachment on the long established monopoly of the local commerce held by his country. Andrade therefore attacked the English vessels, but suffered a repulse, chiefly through the poor quality of his native crews, for he was a brave and competent officer himself. His failure to drive them away enabled them to carry out their mission, on the completion of which they returned to Surat without further adventures; but as his squadron, though defeated, had withdrawn without serious loss, it remained a menace to English aspirations in that region, which had to be removed if they were to prosper in safety.

The matter, however, went further than that, for the presence of the Portuguese in the Gulf was a standing offence to Shah Abbas also, who ardently desired to recover the island of Ormuz so long lost to Persia, but having no fighting ships was powerless to send an army across while Andrade stood in the way. In the well-armed vessels of the London Company this astute monarch saw the solution of his difficulty, and he made it a condition of allowing them to trade in his realms that they helped him to take the coveted Portuguese possession. The English therefore found that their prospects in Persia were more than ever contingent on the destruction of the Portuguese squadron; but as Andrade could always be reinforced from Goa

during the winter monsoon, which was the only season when he could be attacked by a fleet from Surat, his destruction or dislodgement was too formidable a project for the Company to care about till Goa came to be shut up. With the Portuguese headquarters blockaded the English officers at Surat knew precisely what force they would have to deal with in the Gulf; and as Abbas was urging them to get on with the business they despatched nine vessels to take it in hand under Captain Blithe of the Company's service, but kept the British government in ignorance of their proceedings. Blithe did his work well, and on his approach the six ships of the Portuguese squadron retired under the guns of Ormuz citadel. A multitudinous riff-raff of Persian troops were then brought over for the land investment, who with Blithe's help conducted a siege which could only have one end, and in spite of a gallant resistance Ormuz was lost to Portugal for ever by a general surrender of the garrison and destruction of the defending squadron.

Thus went the first of the three principal sea fortresses established by the genius of Albuquerque a century before, as centres of trade and strategic bases for the forces controlling the traffic of the Indian Ocean; and its downfall can be viewed as an event in either British history or Portuguese. British historians' references to the episode have perhaps naturally all treated it from the British standpoint, but none seem to have pointed out the important influence of the blockade of Goa on the story of the expedition, without which it would in all reasonable probability never have been launched till at least long after. To obtain the true perspective of the general maritime situation we must realise how the Portuguese saw it; who make it sufficiently clear that the capture of Ormuz, though providing more spectacular material for history than the sealing up of their eastern capital, was certainly no more serious as a blow to their interests. It was advertised by powder-smoke and bloodshed, the burning of a small squadron, the surrender of an admiral and the garrison of a rather obsolete work; whereas the blockade did not cause the firing of a single shot. Yet the loss of Ormuz was no more than the amputation of a limb to Portugal in the east, while the closure of Goa was a

grip on the heart itself, completely stopping its beat for the moment And though on this occasion the blockaders relaxed the pressure before commercial life became extinct, the temporary paralysis it caused served to show that the method could be used with fatal results if long enough maintained, of which the Dutch duly made a note.

In so far as it prevented any possibility of Andrade's squadron coming to the rescue, the attack on Ormuz was as helpful to the blockade as the blockade was to the attack, and the fact that two separate series of operations were possible at the same time proved how completely an Anglo-Dutch partnership could dominate the eastern situation. From this point onward it is highly instructive to note how the once great status of the Portuguese on the seas and shores of Asia deteriorated step by step with each phase in the waning of their maritime power. Less than a quarter of a century had elapsed since Portugal dominated the Indian Ocean without a rival and her trade and possessions were alike secure. Then came an interval in which, though not called upon to face armed opposition on a serious scale, her trade began to suffer from a competition which she was no longer strong enough to exclude. And now a further stage was reached, in which through a forcible and wholesale restriction of the movements of her ships, not only did her trade fall away almost to the vanishing point, but her chief land strongholds began to fall away also, of which Ormuz was the first to see the flag of Lusitania hauled down. A brief pause on the downward path followed through the despatch of her only naval reinforcements from home in a last effort to hold her own; but when these were again outnumbered by her enemies, her decline once more set in and continued with gathering momentum till nothing but a parcel of fragments of the position she held throughout the sixteenth century remained to pass on to posterity.

IX

The DOWNFALL of PORTUGAL in the EAST

THE first blockade of Goa with the simultaneous loss of Ormuz taught the Portuguese that if they wished to retain any semblance of power or importance in the East they must reinforce their fleet in the Indian Ocean without delay. Such additional ships as were still at their disposal in Europe were sent out accordingly, and for some time this local increase of strength sufficed to prevent their antagonists from embarking on further operations—such as blockades—of a nature demanding prolonged and serious effort. But the policy adopted in 1619 by the Dutch and English Companies of mutual aid in opposing the Portuguese remained in force for ten years, and, though not applied as a foundation for any regularly planned scheme of conquest, did nevertheless bear fruit in occasional acts of aggression in which the ships of the two companies operated in concert. Thus in 1624 and 1625 Anglo-Dutch squadrons attacked the Portuguese division stationed at the entrance to the Persian Gulf, and in 1626 made a descent on the small Portuguese settlement on the island of Bombay. It could hardly be claimed that any of these attacks were notable events, for the first two had no decisive issue—and even led to the loss of the only British vessel ever destroyed by the Portuguese in the East—and the third was no more than a raiding and burning enterprise. But their significance lay in the fact that now the Anglo-Dutch combination always took the initiative. Matters therefore had arrived at a point in which the Portuguese were relegated permanently to the defensive, and, though Goa was again an open port for the time, the fact that they had reached the end of their tether as regards naval reinforcements, while the fleets of the Dutch and English Companies were growing stronger every year, cast a serious shadow over their outlook for the future.

It chanced at this stage that their relations with the Mogul Emperors who ruled all northern Hindustan underwent a change for the worse from a variety of causes, not least of which was the friendly attitude of these magnificent autocrats

towards the agents of the London Company, who they had permitted to settle in Surat. And by this estrangement the English profited in an unforeseen fashion, for it was the practice of the Portuguese Viceroys, when on bad terms with the court of Delhi, to hold up the native craft engaged in taking pious Moslems from India on their annual pilgrimage to Mecca. Such interference caused much exasperation to the Emperors; for these lords of formidable armies, like the great Shah Abbas of Persia, were as helpless as sheep against any white men on the water, and followed his example by turning to other white men to help them, in the shape of the English, whose services were available at a price. Once more, therefore, ships belonging to Deptford and Wapping were placed at the disposal of an oriental prince, as a condition of facilities for trade, and this time the facilities were forthcoming, for the Moguls were better at honouring a bargain than the Shahs. The Portuguese were given to understand that the pilgrim carriers and all other vessels in which the Moguls had an interest were thenceforward under the protection of English guns, and the English factories in Surat were raised to high favour at Delhi.

The whole position and policy of the London East India Company at this period—and for quite sixty years thereafter—merits indeed the attention of all who are interested in the various forms of national effort exerted across oceanic spaces, as disclosed in general history. If Francisco Almeida, the first Portuguese Viceroy of the Indies, had been alive in the first half of the seventeenth century, he might have pointed with no little justification to the growing power and wealth of the English commercial adventurers in north-western Hindustan as a complete vindication of the views on Asiatic enterprise, which he urged in vain on his sovereign's acceptance; for the Company and its servants pursued their business precisely on the lines which he recommended. "Devote all your attention to strength on the sea," wrote Almeida, "and avoid misplaced expenditure on fortresses or other commitments on the land. So shall Your Majesty's interests prosper in the east." King Manoel did not approve of these principles. The merchants of

London did. They were content to thrust an office manager ashore as their chief representative at Surat, between Goa and Diu—the two greatest sea fortresses in all Asia—and provided him with a bungalow, a "factory" or warehouse, a few clerks and boatmen and a stand of flintlocks. Not a rampart, wall, ditch or gun defended his five-acre plot. But he was empowered to control the movements of all the ships of the Company's fleet in the Indian Ocean; and because they outnumbered the fleet of Portugal, this private gentleman and commercial accountant commanded the entire sea area between Arabia and Hindustan; in virtue of which he not only sent home more wealth from the East than the Crown officers of Portugal, but outbid them for the goodwill of the great rulers of Asia, Mogul or Persian, and conducted diplomatic negotiations on fully equal terms with the Viceroy of Goa, who lived in regal state surrounded by men-at-arms and almost impregnable fortifications.

It cannot, however, be doubted that the officers commanding the ships under his orders were sorely harassed by the want of an adequate dockyard and arsenal under the Company's own control; and the fact that in spite of the absence of any maintenance facilities other than those obtainable from native sources, they did somehow contrive to keep the upper hand of the Portuguese, with all Goa docks at the latter's disposal, proves them to have been past-masters of their profession, as indeed we know from other evidence that they were. The truth is that all oversea enterprise conducted at a great distance from the mother country should preserve a certain proper ratio between its number of ships and its oversea holdings on shore, if the best results are to be obtained, which the Dutch realized with their usual shrewdness at an early stage. But the effective ascendancy of the English over the Portuguese from the period here under notice proved nevertheless that in the sailing era, as Almeida had insisted, ships *could* command a large sea area without the support of fortresses in the same general region, though under a handicap. Fortresses with insufficient ships most certainly could not, and never have or will.

To the general trading element in the native population

these changes were at first perplexing; as the native mind is more apt to be impressed by the sight of troops than of ships, and the traditions left by the naval bombardments of a hundred odd years before had grown dim. As far as the Hindoo vendor of merchandise could appreciate the outward evidences of authority, the handsomely accoutred garrisons at Goa and Diu seemed a proof of power that was entirely absent in the English concessions, where the only white men to be seen were a few perspiring clerks and sea skippers in very unpretentious garb. But when the natives realized that these latter were quite as well treated by the officers of the great Mogul as the plumed Portuguese, and furthermore, that of these two white peoples the English had much the most money to spend, they gained confidence to enter into business relations which became permanently established.

In 1625, the private quarrels of the London East India Company with the Portuguese became merged in a national war between the mother countries arising from affairs in Europe. As the Company was authorized by the Crown to fight against all enemies of the State, its hostile attitude towards the Viceroy of Goa assumed a national and regular character, which remained during the five years elapsing before the return of peace in Europe in 1630. But after the already-mentioned raid on Bombay in 1626 the Company remained content to follow its commercial pursuits, and a somewhat curious situation ensued; for though a condition of formally declared war had succeeded a condition of unrecognized private hostility, the actual exchanges of blows became few and insignificant. The truth was that the sentiments hitherto uniting the English and Dutch Companies in opposing the Portuguese were weakening on the English side, as a consequence of increasing commercial rivalry and the menacing growth of Dutch sea-power. Fears were aroused that the London trade would have more to suffer in the future from the ostensible allies of the Company than from its ostensible opponents, and when peace between the sovereigns of Britain and Portugal was restored, the policy of the London merchants began to move in the direction of an understanding with the Portuguese Viceroy. The latter, for his part,

had long since realized that in remaining perpetually at feud with both the Companies the Portuguese were making a mistake; for the blockade of Goa, with the simultaneous loss of Ormuz had proved their inability to withstand two such adversaries at once. And though the subsequent arrival of several more ships from Lisbon had helped them in some measure to reassert themselves, the English compact with the Mogul Emperors had added another difficulty to their future. Meanwhile the steady expansion and implacable enmity of the Dutch were constant and growing sources of anxiety at Goa. When, therefore, the English Company made its advances, these did not suffer the peremptory rejection that would certainly have been their fate a few years before; and though the Viceroy moved with diplomatic caution, the situation was slowly but surely eased on both sides, till after a prolonged exchange of views, lasting till 1635, a formal accord was reached whereby each party pledged itself to settle all disputes with the other by peaceful methods

Relieved of anxiety on that side, the Portuguese were left to confront the Dutch alone for a whole generation, and the main thread of Indian Ocean history during that period was simply the tale of the struggle between these two white nations in the East: a conflict marked by occasional brief pauses in the actual clash of arms, but never relaxed in spirit. The English Company watched its progress with close attention, as spectators whose own interests sometimes benefited and sometimes suffered under a perpetual atmosphere of strife between their neighbours, and whose sympathies were increasingly evoked on the side of the Portuguese as it intensified, partly because Great Britain and Portugal were being drawn politically together in Europe by the events of the time, and partly because it was obvious from their whole conduct in the Archipelago that the Dutch would be an aggressive and disturbing element in Eastern seas if in a position of undisputed dominion. But it was a one-sided fight for supremacy from first to last, in which the Dutch struck where and when they pleased, and by superior force, staying power and weight of blow left their enemy weaker after every exchange, till finally laid prone altogether.

With the Dutch Company, early commercial profit had proved as usual an immediate stimulant to expansion, and in an extreme degree. Hence in the period following the first twenty years of its existence, its record of accomplishment lends a remarkable prominence to the share of Holland in the making of maritime history. In pursuit of an oceanic hegemony of the East, somewhat on the model of Albuquerque, Governor Coen and his followers—having little scruple about seizing anything that they were strong enough to take, after a not uncommon sea fashion of the period—travelled a long way towards complete success, and furnished in the process a most conspicuous example of a wide acquisition of political and commercial power through a skilful use of naval armaments. Towards the question of property and influence on land their attitude differed from that of the English Company, who held no more land than was absolutely necessary as little patches for their factories, and sometimes even censured their servants for increasing the number of these. The Dutch believed that the best way to secure trade was to establish an effective control of the area from which it sprang, and carried their forcible subjugation of the native rulers in the regions where their commercial operations were chiefly centred much further than even the Portuguese; though in many cases they adopted the Portuguese precedent of leaving to these rulers a considerable measure of delegated local authority. In this way the large islands of Java, Sumatra and the Moluccas were compelled to submit to a Dutch monopoly of their exports. Others, which were smaller and held by the Portuguese, they seized and placed under governing officials of their own.

Of the English Company they stood in no fear until Cromwell's time, a generation later. Their own syndicate had acquired in twenty years so important a place in the national prosperity of Holland herself that it could always rely on government support, and Holland was superior then to England as a sea power. The English Company, on the other hand, contributed a much less important share towards the general prosperity of the mother country, and could rarely count on official protection in any material form, even had the King's

navy been strong enough to extend it. As a result of confidence in the approval of his compatriots, one of the higher servants of the Dutch Company pushed matters to their farthest extreme in 1623 against the handful of Englishmen stationed in the clove island of Amboina, where one of the last small trading ports of the London merchants in Malaysia still remained. In the temporary absence in Europe of Coen, during the interval between his two commissions as Governor-General, this official arrested and executed the whole Amboina staff, after torturing them to extract confessions of offences against Dutch laws which they had never committed. And the Dutch State upheld his action. It can hardly be said that the incident had any material effect on the general strategic and commercial situation in the East, either at the moment or for long afterwards, as in spite of a great explosion of public feeling when the news reached London, English efforts to obtain redress were confined to vociferous protests and threats of action that never took shape till Cromwell was in power thirty years later. But it did direct English national attention to the activities of the London Company far more than ever before, which increased as England became by degrees a sea state, till a period eventually arrived when the Dutch had to think twice before offering violence to the Company's interests.

After the Amboina episode, however, the English—having already abandoned Bantam for the time—were no longer in any way an obstacle in the Archipelago, and, with the Dutch position on the eastern side of the Indian Ocean well consolidated, Dutch ambitions for the control of its whole surface next required that the Portuguese should be eliminated on the north. That this would be a formidable undertaking, their own experiences at Malacca made evident; but so long as they could be kept from competing in trade, the actual seizure of the main Portuguese colonies and fortresses might wait. When ready with a sufficiency of ships a few years later, a general offensive against this rival European state in the East was therefore resumed, and carried through with great concentration of purpose, thoroughness and patience, though the ensuing war proved lengthy.

It would be perhaps too much to say that the Dutch worked to a programme in the matter of time, for though they never rested they were never in a hurry, and taught by the lesson of their former reverses at Malacca, avoided risking further checks through attempting too much at once. But they always knew what they meant to do next, and how they meant to do it; and every forward move was not only carried out in methodical fashion for its own immediate purpose, but so arranged as to be if possible a stepping stone for the next Thus, though constantly aggressive, they were seldom rash; not because the Dutch service lacked venturesome officers, with such notable leaders as Heemskerk, Van Diemen and Piet Hein, but because they foresaw that with the means at their disposal they could more surely reach success by slowly tightening an irresistible screw, under which their opponents were powerless to retaliate, than by any precipitate forcing of the issues at stake. For nearly twenty years, in consequence, the policy of a brilliant or spectacular onslaught made no appeal to their councils, but not Albuquerque himself could have accomplished more in the end with the instruments at their command.

As all their schemes depended on retaining the power of the initiative, their prospects of success were necessarily founded on absolute liberty of movement by sea, demanding firstly a windward position from which to launch all maritime enterprise, and secondly, an eastern fleet with a margin of superiority over any reasonably likely combination of enemies. A windward position they already had, but not as yet a sufficient number of keels. When, therefore, the Portuguese sea forces were augmented after the blockade of Goa in 1622, the Dutch Company devoted their attention even more than ever towards increasing their own, till they were strong enough to face even the contingency of an Anglo-Portuguese armed coalition, which, though at the time improbable, was not beyond the bounds of possibility. If they could have increased their troops in the same proportion, they would have made much shorter work of the Portuguese than they did; but the military resources of the Dutch Company at that period, though enough for the overthrow of the ill-equipped native armies of the

Malay Sultans, were still far below the standard required for direct assaults or sieges of powerfully defended positions held by Europeans, such as the main Portuguese sea citadels, and in operating against these they were compelled for many years to rely on naval action alone.

A purely maritime offensive, however, when conducted by such masters of the science of sea warfare as the countrymen of the Van Tromps and de Ruyter, proved quite sufficient to secure their primary object: that is to say, the stoppage of all Portuguese sea-borne traffic in the East. Having seen the serious injury which a single season's blockade had inflicted on Goa on the first occasion of its trial, the Dutch, when ready to begin a fresh general offensive in 1630, based their whole strategic plans for fifteen years of unbroken warfare on the principle that though an enemy's ports may be too strong to be themselves a direct object of attack, the trade which brings them into existence and maintains their importance as a national source of wealth, may be diverted elsewhere by a superior naval adversary who is under no necessity to force a quick decision. Ships alone, therefore, were to be used to depose Goa and Malacca from the position they had occupied for a century as the chief points of intercourse of the men of the East and West; and on these two cities a close sea blockade was imposed for a long term of years, which strangled their industry till the grass grew in their streets and half their populations had deserted them.

But at the outset the Dutch did not possess enough vessels to seal up both points simultaneously without a dangerous division of force, for the Portuguese fleet stationed on the Malabar coast with a detached squadron at Muscat was not a negligible factor. As they were thus compelled to restrict their opening move to one direction, their choice fell on Malacca, which was the nearest to their own headquarters. Fifteen years had passed since the second of their two former attempts on this fortress had failed; and in the interval their ally, the Malay King of Acheen, whose father and grandfather had both attacked it without success, tried to take it in his turn with an immense and well-armed expedition, but suffered

a like disaster through the same cause: that is to say, the timely arrival of a relieving fleet from Goa on the change of monsoon. This was the tenth occasion, during one hundred and twenty years of Portuguese occupation, in which a hostile fleet conveying strong land forces had found it impossible to reduce this unshakeable position; sometimes through being defeated by a defending fleet before the troops were ever put ashore, and sometimes through defeat by a relieving fleet when a land siege had begun. Never did it fall back into the hands of the brown man after a European flag had been hoisted over its walls, and never was it destined to be wrested from the Portuguese by any assailant, white or brown, except through the sheer exhaustion of eleven years' severance from all help, which was now about to commence.

Under the Portuguese, as under the native Sultans who preceded them, Malacca was chiefly important as a point of collection and transhipment of cargo; whither goods were conveyed in small craft from the Malay Islands, Siam and China, to be put on board large ocean-going ships for the long westward voyage; and the special aim of the Dutch was to divert the incoming coasters to their own port of Batavia, which, though not quite so well situated for the collection of freights, provided on the other hand an excellent starting point for the homeward passage *via* the Straits of Sunda, through its locality in the fair trade wind for west-bound sailing. Round Malacca, therefore, they proceeded to place a sea encirclement its defenders could never hope to break, even if assisted from Goa; to which end a very strong Dutch squadron arrived off the port in 1630 and slammed its sea gates. Incoming native craft, with goods for sale or transfer, were pointed the way to Batavia; outgoing were relieved of any cargo on board—under compensation unless Portuguese property—and then allowed to proceed in peace, on the understanding that they came to Malacca no more. One and all were notified that as a place of any importance its history was at an end till the day should come when it flew the Netherlands flag. As the season's homeward bound Portuguese ships had sailed, and the small squadrons stationed in the Straits retired on the Dutch approach, no

Portuguese vessels were captured; but none ever anchored in that roadstead again.

Though the action taken answered its purpose by diverting trade at once, the Dutch found that they were never able to relax their vigilance without some tendency of the stream to slip back a little to the old channel; and as Malacca—unlike the Malabar ports—was at no season of the year regularly closed to exit by the weather, blockade-running was always possible if the blockaders kept a bad look-out. It was the fault of the Dutch themselves, that when on one or two occasions they withdrew the watching ships in order to meet the requirements of homeward bound transport before others were ready to take their place, some trading actually occurred, though it was impracticable to send reinforcements or munitions from Goa, owing to the adverse monsoon blowing at the time in the Bay of Bengal. These lapses, however, were few; and as the same weather conditions that permitted blockade-running when no enemy was in sight also permitted the enemy always to be on the spot if he chose, it was the rarely violated practice of the Dutch through summer and winter alike to keep a sufficient force within sight of the port but outside the range of its guns from 1630 till 1641.

By cutting off the garrison from any outside maintenance or relief the effects of the blockade were military as well as commercial; though from that standpoint they were necessarily very slow in producing results as compared to a successful direct assault. But they were sure, for though no shortage of food troubled the defenders—owing to its procurability from adjoining native territory on the land side—no replacement of the losses to man power by frequent deaths and desertions in an unhealthy climate was possible; and the long and complete isolation from the mother country was naturally demoralizing to the comparatively small and steadily decreasing band of Europeans, upon whose military efficiency the Portuguese hold on the city against enemies external or internal was immediately dependent. After holding out for eleven years their number had dwindled to such a point that the fortress was like a withered apple, ready to fall at a touch, and the Dutch

decided that the time for gathering had arrived. A direct assault was delivered, therefore, on the sea front of the citadel, after a preliminary fleet bombardment, which met with so little resistance that the attackers almost walked straight in; and the fortress passed into the hands of the Dutch a hundred and thirty years after Albuquerque had raised its walls, having survived ten separate attempts at capture in the interval. The great position of Portugal in the East created by his genius was crumbling through the lost Portuguese rule of the Indian seas on which its foundations rested.

Five years before the end came at Malacca the Dutch had added still further so greatly to their fleet that they began to impose a similar infliction on Goa, where a strong blockading squadron arrived in the winter monsoon of 1636. Here the problem was profoundly different both tactically and economically. Tactically it was an easier operation than at Malacca, because, owing to the closing effect of the summer monsoon, the blockade was only necessary during the winter; but economically it was more difficult, because Goa was an exporting rather than a transhipping point for goods, where they arrived for sea loading by land routes over which the Dutch had no control. To prevent these goods from passing out again by sea was not in itself the ultimate aim of the Dutch, who wanted to go further than that and ship the goods themselves. But as they were powerless to compel the traffic to change destination in the simple and summary fashion employed at Malacca, they were obliged to offer alternative markets on the Indian coast in their own hands, and trust that the laws of supply and demand would operate, which in time they did. Acceptance of delivery was already possible at several such points when the blockade began, through the previous acquisition of factory sites at certain harbours and anchorages on both sides of southern Hindustan by negotiations with native Princes; and to these outlets—which were being increased in number—the native producers naturally turned their eyes when they found after a time that selling was no longer possible at Goa. Thus, though trade could be forced away from Malacca, it could only be lured away from the

Portuguese capital in Malabar; and the process was longer, as the sellers had to be well satisfied that, in deserting the port which had been the commercial headquarters of southern India for four generations, they were acting with prudence. On the other hand, traffic, when once diverted, had less tendency to drift back to its former goal if opened again than it had at Malacca; for whereas the latter port held in many ways a more convenient situation for the traffic requirements of its own region than Batavia, no such advantages over the Dutch ports round India were enjoyed by Goa or any of those in Portuguese possession. Hence it was that though the Dutch were always set upon acquiring Malacca itself sooner or later—and there kept up the effort of blockade till the city fell—they never harboured any such intentions towards Goa, where the blockade was lifted when it had effected its purely commercial consequences. Goa was certainly a more difficult place to capture, but its reduction was possible by a similar process of military exhaustion, had the Dutch considered the inducements sufficient.

The blockade of Malacca lasted with scarcely any intermission for eleven years, but eight successive seasons answered the purpose at Goa. As already observed, the latter sea investment was started before the former had come to an end, and the periods of the two overlapped and ran concurrently for five years. In undertaking the second while the first was still in hand the Dutch acted with more precipitance than was usual with them. They were merciless taskmasters to their own seamen and ships in the seventeenth century—as the British were in the eighteenth—and in expecting their admirals to conduct both blockades simultaneously and successfully with the fleet available, the Dutch Company were asking almost too much; for the division detailed for duty at Goa had so narrow a superiority over the Portuguese squadron stationed there in the first and second seasons of blockade, that the latter sallied out to attack them three times, and were only prevented with great difficulty from breaking up the investment after severe engagements. Each season, however, a fresh set of vessels were employed, and after the third Portuguese sortie the force

watching Goa was strengthened and maintained at a standard sufficient to prevent any further attempts of that kind till the end.

From 1637 till 1645 this stoppage of the homeward flow of eastern freights from Goa remained in force; and the fresh direction which it gave to the intercourse between Europeans and the natives of India had far-reaching and long-enduring effects on Indian developments by establishing the Dutch in a position of high importance in native estimation. And in one respect its interest and consequences were world-wide, for at Goa the Hollanders introduced a new and extremely controversial policy, by refusing to allow neutral ships to enter or leave any more than Portuguese, and thus practised for the first time commercial blockade in its fullest sense. For some years previously the London Company had obtained permission from the Viceroy to load two ships annually at Goa; and the Goanese authorities chartered others in which, by placing their pepper sacks under British hatches, they hoped to send them home unmolested by any Dutchman on the voyage; thereby raising the vexed question of the usage of neutral flags, which has furnished international lawyers with a topic of argument for centuries.

The blockade upset all this. The Dutch were aware of the practice, but on the high seas did not care to risk provoking armed conflicts by trying to search vessels under British colours whose port of departure they did not know, on the chance that they might have sailed from Goa with Portuguese goods; for such a universally recognized belligerent right at the present day had never been acknowledged or even raised. Immediately outside of Goa the case was different, for here they could be seen emerging, and everything that sailed thence was indubitably a source of profit to the Portuguese authorities in some way; either as owners or as collectors of export dues. This the Dutch were determined to stop; and their attitude, with its potentialities of trouble with the English Company, affords a good indication of the confidence and sense of power animating their whole proceedings at this period. The English remained content with verbal protest; though only two years

before, the alarm they shared with the Portuguese on the arrival of the first Dutch visiting fleet in the Bay of Bengal, had resulted in the Anglo-Portuguese truce which became an active alliance twenty years later. But until the alliance took shape nothing in the truce laid any obligation on either party to help the other if attacked; or even to abstain from profiting indirectly by the other's losses, as the Londoners to some extent now did by the flow of native trade from Goa to other Indian ports. Thus they violated no letter of the agreement by a cautious if selfish policy.

By the fourth year of the blockade of Goa—which was the ninth of the blockade of Malacca—the state of Portuguese affairs in eastern seas appeared to the Viceroy to be so hopeless that in a despatch to the Lisbon government—sent overland to the Mediterranean and thence on, to avoid Dutch interception—he expressed the deliberate opinion that with their ships no longer able to sail the Indian Ocean, there was nothing left but to haul down the flag in all their Asiatic possessions and quit the East for good. Ormuz had gone, Malacca was now in the last extremity, Goa was fast becoming a dead city. This counsel of despair was supported by such hard logic that it might perhaps have found a resigned acceptance, had it not been for the fact that the affairs of the Portuguese people were just then taking a turn from which their political leaders expected great results. Some sixty years before, their ancestors had made the mistake of assenting to the claim of Philip II of Spain to the Portuguese Crown; an error regretted ever after, for though Philip and his successors allowed them domestic self-government, they bled Portuguese finances mercilessly on behalf of the Spanish wars. The Portuguese nobles, therefore, were scheming to re-establish a separate kingdom on a basis of friendship with Britain and Holland, both of which countries still detested but no longer feared the Spaniards. This scheme materialized in its main outline, though its consequences did not extend so far in their favour as the population of Lisbon had hoped. In 1641 the Spanish dynasty was repudiated by the enthroning of King John IV of Portugal, who proceeded at once to arrange anti-Spanish treaties with the British and

Dutch governments, for the purpose of securing the safety of his crown and the integrity of his realms at home and abroad. Believing that Goa would be freed from Dutch persecution by some understanding of this nature, the authorities at Lisbon had not approved of the Viceroy's bag and baggage policy of withdrawal when preparing to declare for independence from Spain; and if the Dutch government had been masters in their own house this confidence would have been justified. Unfortunately for the Portuguese, however, the officers of the Dutch Company refused to regard European made treaties as carrying any authority or sanctity east of the Cape of Good Hope; and so great was the difficulty of enforcing official decisions in those days at a distance of 12,000 miles, that, in spite of positive orders to the contrary from the National Government, the Company's executive at Batavia continued to blockade the Malabar ports.

Nor were the misfortunes of the Portuguese confined to these vital centres of industry, for they suffered from attacks in a fresh quarter, soon after the blockade began, which, though of less immediate consequence to their political and commercial interests, afforded a significant forecast of the growth of Dutch ambitions. The large and fertile island of Ceylon—one of the great prizes always held by the premier power in the Indian Ocean—had acknowledged the suzerainty of Portugal for 120 years, and all its external trade had been under Portuguese control during that time. But the Dutch were now casting covetous eyes on Ceylon. As already observed, they were greater annexationists of territory than the Portuguese; but, depending as they did so much on sea armaments for safety, it was towards insular rather than continental situations that their inclinations turned, and all their really important foreign possessions were islands, of which Sumatra and Java were the largest. Sumatra in fact was so large that the mountain tribes of the interior gave constant trouble and were never really subjugated. Ceylon, though much smaller than Sumatra, had a greater export trade and was far more easy to hold against revolt, partly on account of its lesser area and partly because its population had little of the warlike quality of the Malays.

Offering as it did, therefore, every advantage which could attract the Dutch, its loss to Portugal sooner or later was a foregone conclusion when once the rule of the Indian Ocean had passed under the flag of the Netherlands Company; a symbol of perpetual feud against all things Lusitanian.

As usual, however, the Dutch methods here were deliberate and cautious rather than hasty, though none the less effective. Ceylon was not slashed away from the realms of Portugal at one blow, but carved away piecemeal; good care being taken during the process to prevent any help reaching it from outside, towards which end the blockade of Goa naturally contributed very materially. It was the blockading squadron itself—when released from its watch every year by the south-west monsoon—that formed the instrument whereby the first slices were cut off. All through the winter, when the weather would have permitted the transport of reinforcements from Goa to Ceylon, the blockaders held them up; and when the summer monsoon made the blockade and the sea movements of troops alike impossible, the blockaders took the opportunity of delivering an attack at some point in the weakened island possession for three successive years, in sailing past it on their way to the Bay of Bengal. This began in 1638, when the blockade was under van Diemen, who, in passing Ceylon for the first time eastward anchored at two points on the east side, at a safe distance from the Portuguese military centres in the island, and there set up two commercial agencies in well-defended positions. Next year, reinforced from Batavia, he made the first move towards attacking the Portuguese in their actual military centres, by bombarding the sea fortifications of Trincomalee and Baticaloa. Trincomalee, which is the finest natural harbour, not only in Ceylon, but on the whole western side of the Bay of Bengal, now became available as a shelter for weather-distressed Dutch Indiamen, even if not yet a point for trade; but as its exit faces north-east it was a bad harbour to emerge from during the winter monsoon in the days of sailing ships. To secure a footing in Ceylon free from this drawback the Dutch resolved to seize Galle, a bay at the southern end of the island facing the opposite point of the compass to Trincomalee and

held by a small Portuguese garrison only. Next year, accordingly, the fleet *en route* from the Goa blockade to the Coromandel side attacked and captured Galle, which for several years became the Ceylon headquarters of the Netherlands Company. These losses were in themselves less serious of course to the Portuguese than the commercial ruining of their Indian seat of government and capital city by Dutch sea power; but as indications of the scope and direction of their opponents' policy they greatly increased the alarm and anxiety felt in Lisbon. For a few years after the capture of Galle, however, the Dutch suspended offensive operations in the island, for they found that further acquisitions by force would call for the use of more troops than were at their disposal. But this was only a respite, and in no way denoted any change of ultimate intentions.

By the year 1645 eight seasons of maritime investment had so completely killed the trade of Goa that it never fully returned, the blockade having proved to the natives that the Portuguese were no longer able to hold their own at sea, and thus destroyed the confidence without which commerce never thrives. Thenceforward Albuquerque's great focus of eastern sea intercourse sank into insignificance for all time. It was in vain that the Portuguese struggled to throw off the iron grip of the enemy. Thrice they sailed out in attempts to drive away the blockaders, but only one of these sorties—made in the first year of the blockade when the Dutch were in comparatively small force—met with even a temporary degree of success by compelling a brief retirement. Both the others were repulsed with heavy loss. By 1645, therefore, Lisbon had finally lost its position as a European market for the sale of eastern wares, Malacca and Ormuz having passed out of Portuguese possession and Goa having ceased to send home any cargoes. Finding no spices to buy on the Tagus the merchants of the West—Catholic as well as Protestant—turned to Amsterdam and London; and having thus attained their prime ambition of wresting eastern trade from under the flag of Portugal, the Netherlands Company brought the blockade of Goa to an end, and for several years thereafter employed their whole fleet in

sending home the freights that were falling into their hands on every side. The movements of merchandise in the Indian Ocean thus passed finally from the control of a Catholic crowned head to that of Protestant private speculators.

Even so, however, the Portuguese were not to be left in peace; for the obvious decay of their power had not unnaturally awakened unrest among the many Asiatic races who had once trembled before it, and some were now scheming to recover lost possessions. Foremost among these were their ancient enemies on the Arab side of the Persian Gulf, to whom soon came intelligence of the Goa blockade, as it did to all dwellers on the shores of the Indian Ocean. Though not at first greatly excited by the news, they discovered after a time that the fortress of Muscat—mainly held by Indian troops from Goa under European officers—was no longer receiving either drafts of men or supplies from that quarter; and only the occasional arrival of a ship all the way from Lisbon kept the garrison from the direst extremity of distress. Encouraged, therefore, by the apparent weakness of the defence, the Arabs of the Oman regions combined to attack and plunder the city; but so slowly did their plans mature, that the blockade of Goa was finished and the Muscat troops relieved by fresh contingents from India long before they were ready to move; nor was it till 1648 that a loosely knit but very large coalition of surrounding tribes besieged the fortress by land and sea during the summer monsoon, when they knew that no help could reach it from Goa. For two months and a half they were held at bay by a very valiant defence, but an Indian native merchant, who had quarrelled with the Portuguese, betrayed weak points in the lines which compelled surrender. By the terms of capitulation the Portuguese pledged themselves to demolish all their minor fortified outposts at Kalyat, Khoryat and other points on the Arabian coast, and to refrain from any further interference with Arab sea trade. But as eastern Arabia did derive some advantage from Portuguese trafficking with the natives, small though these might be, the victors permitted the vanquished to retain their factory in Muscat with a limited armed force, confident that this settlement would always be at

their mercy. A year later, however, the appearance of a Portuguese squadron in the offing, convinced the local Sultan that a recapture of the fort was intended, which instantly provoked a general massacre of every Portuguese subject on shore, European or native. By the old accounts this might have been prevented had the admiral displayed any resolution; but not being an officer of the type of the earlier Portuguese commanders he left his compatriots to their fate and retreated back to Goa, where a court martial sentenced him to death.

In a final effort to reassert in some degree the once powerful position of his country in the Persian Gulf, the Viceroy sent the fleet to Muscat a second time next fair monsoon, under another admiral ordered to spare no effort to recover it. He was so far successful as to compel a large Arab fleet to retire to shelter beneath the guns of the citadel built by Albuquerque to command the harbour, and thus proved once more the superiority of the white man over the brown on the water. But there his success ended, for realizing that the enemy intended to make full use of the defensive strength of the fortress he deemed his squadron insufficient to attack it, and returned to India with his mission unaccomplished. From the fact that he suffered no penalty it seems obvious that he persuaded the Viceroy that nothing more was possible, and Muscat passed to the Arab races by whom it has been held ever since. Thus the close of the first half of the seventeenth century saw Portugal's position in the Indian Ocean, as established by Albuquerque with its centre in Hindustan, shorn of the last feather of its two wide wings whose shadow had spread thence east and west over the Asiatic seaboard for 3000 miles; Ormuz having already been taken by the Persians with British help and Malacca by men bred on the shores of the Zuider Zee.

The loss of the two Persian Gulf fortresses of Ormuz and Muscat has a peculiar historical interest of its own, for of all the points on the shores of the Indian Ocean where the planting of a European flag had brought the benefits of a strong civilized rule these two were the first to revert to permanent Asiatic control, with its attendant tyranny, barbarism and slavery. That the Dutch might have occupied both had they so desired

seems probable, but they decided that their own policy could best be furthered by leaving them in native possession. The trade on the Muscat side had never amounted to much at the best, and the Portuguese hold on the city had been as much prompted by a desire to deny its fine strategic harbour to their Arab enemies as by anything else. But as the Arabs were always too much afraid of the Dutch to molest them, the Dutch, for their part, saw no good naval or commercial reason for seizing this stronghold. Reasons of another kind restrained them from annexing Ormuz, which lay in Persian hands on the other side of the Gulf entrance. So highly did the Shah Abbas and his successors value this possession, from which British ships had helped them to expel the Portuguese, that the island was virtually a hostage which the Dutch fleet could seize at any time if their Company was denied commercial advantages at the Ispahan Court. With shrewd judgment the directors let it stand at that, and established their agency for a newly opened trade in Persian silks at Bunder Abbas or Gombroon, which stands on the mainland exactly opposite Ormuz. From the day when they ceased to be under European rule the degradation of Ormuz and Muscat began. The former has long since sunk to a wretched fishing village surrounding an immense deserted citadel, and the latter to a warren of dilapidated houses with a small trade in dates and dried fish, though for an interval it enjoyed a prosperity as a great slave market of the worst description.

To the Portuguese only patches of the coasts of Hindustan and Ceylon now remained of their former territories on the margin of the Indian Ocean, but for a space the turn of international events in Europe seemed to offer a possibility that farther shrinkage might be averted. In 1652 the long series of desperately contested struggles between Britain and Holland of the later seventeenth century broke out; which in their cumulative effect diverted the whole course of Indian Ocean history by shattering Dutch sea power. When the announcement of a state of hostilities between the mother countries reached the East a year later, the employees of the Dutch and English Companies in those distant regions stood towards each

other as adversaries in war on a perfectly legal footing, both having the right by their charters to attack declared enemies of their country. This of course meant that in the Indian Ocean the Dutch had two flags to meet instead of one, and in aggregate numbers of ships the odds were in favour of their opponents. By this change in the situation the position of the Portuguese was naturally much improved, on paper at least, and their hopes of revenge rose accordingly.

Fortunately, however, for the Dutch, the Anglo-Portuguese comradeship in arms was of the loosest description, and suffered in an almost exaggerated degree from the drawbacks inevitably attaching to alliances between partners whose ultimate aims are independent. Each had their own policy, and no proper understanding of the true principles of war induced them to look beyond it for a moment. The immediate object of the Portuguese was to recover what they had lost; the immediate object of the British to retain what they held; but it never seems to have occurred to either that the first step towards both ends should have been a concentration of all their ships to defeat the main Dutch fleet, after which they could act separately if they pleased. The Portuguese vessels consequently remained inside their strongly defended base at Goa, undecided on any plan of action; while the British lay at their anchorages on the coast of Surat—which had no sea defences of any kind—and while waiting for something to happen went on bargaining for pepper. To this futile inactivity the conduct of their adversaries offered a marked contrast. The Dutch Company had a definitely positive policy, knowing not only what they wanted but what they should do to get it. Aiming at an absolute monopoly of the sea trade of the East by controlling its outflow from every port on the Indian Ocean, a total expulsion of the British and Portuguese flags was their first necessity. After that, a Dutch East India Company's rule of Hindustan would become a possibility of the future. The authors of this policy realized of course that as a last sanction everything was dependent on Dutch victory in the home waters; but they were confident that van Tromp would drive the English off the seas of Europe while Goens, their admiral in the

East, drove them off the seas of Asia. Forthwith the Dutch Company's fleet sailed from Batavia to search out the enemy.

No records seem to be in existence now to show whether the Dutch commander was aware of the scattered disposition of the allies, which gave him such an opportunity for striking at them in detail, but with the slow spread of intelligence in those days it seems unlikely. If he gave them credit for proper measures, he probably expected to meet their combined fleets on his arrival on the Malabar coast somewhere not far from Goa; but no such demonstration of force appeared, and as it was very rightly foreign to his intentions to chance weakening his fleet by engaging strong fortifications before the enemies' sea power had been broken, he passed Goa by and sailed on up the western side of India. In this he undoubtedly took risks of a kind; for whether he knew that the Portuguese fleet was inside the harbour or not, the fact remained that its presence there was always a possibility, and when he was anywhere to the northward of this base he left the Dutch possessions uncovered against the danger of a blow from the Portuguese headquarters, which indeed was actually delivered in an irresolute fashion. But an admiral in search of an enemy is bound to take such risks sometimes, as history has amply proved, and in persisting to hunt for hostile fleets where there was a chance of finding them in accessible situations, he followed the basic law of sea strategy till he met with his fit reward. Arriving on the coast of Surat he encountered and defeated the British Company's forces in an engagement which the countrymen of the vanquished can recall with little pride; for though some of the captains behaved gallantly, others showed no stomach for the fight, and the Dutch success was quite as much due to better men as to more powerfully armed ships.

For a brief interval nothing then in the eastern situation stood in the way of wholesale Dutch conquests on the shores of the Indian Ocean, for with the British thrust out only the Portuguese remained to be engaged, whose maritime strength single-handed had long been utterly inadequate to face them. If only the eastern situation had counted therefore no man can say what the future course of Indian history might have been.

Certain it is that the existence of the British East India Company—from which the British Empire in India eventually took its rise—would have been ended there and then. Very fortunately for the Company, however, the western situation counted for even more as a factor in shaping the ultimate destinies of the rival white nations in the orient, and in the West the hopes of the Dutchmen had been shattered by Blake, Monk and Deane in the terrific struggles of the North Sea and English Channel. Forced by these disasters to submit to the British conditions for peace, the government of the United Provinces found itself compelled not only to recognize the full rights of the London Company in the East, but to pay its shareholders a handsome compensation for past injuries at the Dutch Company's hands, including the atrocities in Amboina a whole generation earlier. This brought to nothing the fruits of the Dutch victory at Surat; where their efforts for a general dominion in the East reached their high-water mark. Thenceforward a Dutch Empire of Hindustan became a vanished dream and a British Empire of Hindustan a potentiality, though nothing was further from the minds of the London Company at the time.

When intelligence of the Dutch defeats and the terms of peace reached Batavia about a year later, it naturally fell as a great blow, which placed a limit on their indefinite expansion and destroyed all hope of a monopoly unless the day should ever come when Dutch sea power should again assert a superiority over British in European seas. It was impossible to ignore the treaty in the fashion of treaties between Holland and Portugal. British fleets could now cut off the arrival of the Company's great convoys at the home end of the voyage, or prevent the departure of others outward bound. But nothing in the terms of peace prevented them from continuing hostilities against the Portuguese, especially as the short-lived and ill-fated anti-Dutch alliance had been terminated as far as the English were concerned by the peace itself. On the Portuguese, therefore, their full weight now fell with disastrous results. Mercantile prosperity under the flag of Portugal was already practically extinct; and a considerable increase in the

military forces of the Company since the periods of the blockades twelve to twenty years before, now enabled the Dutch to carry the war ashore, where cities, settlements and trading posts were ruthlessly seized one after another till only a few commercially ruined fortresses and factories remained in Portuguese possession.

If the Dutch had wanted any pretext to lend this extended aggression a semblance of political justification—which may be doubted—the Portuguese themselves had to some extent provided it by striking one solitary blow on the offensive while the alliance with the English Company was still existing. At the time when the Dutch ships were watching the coast of Surat, after defeating the English, the Viceroy took advantage of the temporarily clear route to Ceylon to despatch a raiding squadron from Goa against the fortified Dutch settlement at Galle. But, though the Dutch fleet off Surat had no knowledge of this move till it was too late to intercept it, the expedition effected nothing beyond stopping the Galle trade for a few months, through the reluctance of the Portuguese admiral to risk disembarkations or bombardments while there was a possibility that the enemy might run south from Surat and catch him at a disadvantage. Even if he had destroyed Galle altogether, however, the general situation would not have been materially improved for the allies so long as the main Dutch fleet dominated all sea approaches to India; and in the end the incident merely fired the Dutch with an ambition for wholesale conquests on the land as well as the sea at Portuguese expense, which was a new line of objective. Not long afterwards, disappointment at being baulked of the fruits of their victory over the English intensified this spirit of reprisal against the London Company's late allies.

On the return therefore of the winter monsoon—the favourable season for naval operations on the west coasts of India and Ceylon—they initiated a series of annual attacks on the Portuguese possessions on that side, lasting over four years. Beginning at Colombo, a strong fleet in conjunction with a body of troops captured all the Portuguese defended points in Ceylon one after the other—the ships preventing the

arrival of any help from Goa, while the troops attacked the small isolated garrisons—and by 1658 had swept their adversaries out of the island altogether, after an occupation of 141 years. For a certain period Ceylon now belonged to the Dutch entirely, through the strategic causes whereby it has always fallen under any flag which for the time may have asserted a stable ascendancy in the Indian Ocean since the days of the first arrival of the white man in the East. With Ceylon conquered, the Dutch struck next at the south-western shores of India, the scene of that first arrival, and of the earliest European connection with Asia in the Christian era. Quilon, Cochin, Calicut, Cannanore—all names associated with the imperishable fame of Vasco da Gama, Pedro Cabral, Francisco Almeida and many others of their valiant countrymen—fell in succession beneath the Dutchmen's guns in two seasons of attack. By the year 1660—fifty-eight after the founding of the Dutch East India Company—its admirals had not only whipped the Portuguese flag off the water on that side of the world, but stripped the maritime empire founded by the admirals of King Manoel "the Fortunate" of every holding on shore left after the English and Arabs had cleared their Persian Gulf positions, except the defunct seaports of Goa and Diu and a few smaller scattered posts of which the fishing village on the inner side of an island close to the coast, known as Bombay, was one. Goa and Diu, though dead to trade under the Portuguese, could have been resuscitated by the Dutch and were worth the effort of capture; but the Dutch stayed their conquests at Cannanore and left the Portuguese cities to the northward unattacked for significant reasons, which can best be examined in dealing with the Dutch period of general ascendancy on a later page.

Thus the star of Portugal had finally set over the waves of the Indian Ocean five generations after rising. That period had witnessed the transfer of the rule of this great waterspace from the brown men who lived on its shores to white men arriving from a very distant continent, as a direct result of the latter's superior aptitude for sea enterprise. So revolutionary a change must always stand by itself as a landmark in history;

for not only was it the germ of the present close intercourse between East and West, but the subversion of the authority of a whole branch of mankind over an immense area to make way for the authority of another. Many changes have occurred in the Indian Ocean since then, but all these were merely sub-racial and had their origin in the rivalry of white man with white and not white with brown. But all reached completion through the operation of the same law of the survival of the fittest, as the great change which preceded them; and from first to last the fittest here were those who could best build and use a ship as an instrument of oceanic war. The initial step in the process of elimination had removed the Asiatic to make way for the European. Then followed the sifting out of the Europeans themselves; and when that ordeal commenced the next to go were none other than the Portuguese, who introduced the whole series of contests by challenging the Asiatics, and proved the victors in the first stage.

As is often the case with the eclipse of a period of strenuous national achievement, the close of the Portuguese maritime dominion in the East was not without a certain element of tragedy, for though marred by many gross defects towards the end, it began with a display of fortitude, valour and sagacity that any nation might recall with entirely legitimate pride. But a certain justice attended it nevertheless, as in the downfall of all holders of a monopoly which they abuse. King Manoel's admirals forcibly dispossessed the Arabs of any share in the trade of the East because the Arabs for their part tried by force to keep the whole of this trade in their own hands. And then the Dutch dispossessed the Portuguese for the same reason. In time the turn of the Dutch also came to go under for similar tendencies, but a great era of prosperity awaited them first.

X

The EFFECT of the ANGLO-DUTCH WARS of the SEVENTEENTH CENTURY on INDIAN OCEAN DEVELOPMENTS

THE thirty years of acute antagonism between the Dutch and Portuguese on the shores of Asia, which ended with the Dutch conquests of Ceylon and the southern Malabar seaports, were fruitful not only in great political changes in the east, but in the development of the material instrument whereby these changes were forcibly effected, that is to say, the deep-water sailing ship. Increasing knowledge of naval architecture arose from increased experience in navigation and war, and tended towards specialisation of model; whereby new ships ceased to embody the compromise of purpose characteristic of the old, in which an attempt was made to meet the requirements of both peace and war in one hull. A new practice began to spring up, by which in a progressive degree every keel laid down was completed for launching with either the fighting or the trading object primarily in view; and the reserve buoyancy of the design was devoted to the carriage of additional guns, or to freight accommodation, as the case might be. In the middle ages the only specially built fighting ships were the galleys, which were neither capable of weathering a true oceanic gale nor of mounting a broadside battery; but the large sailing ship could be built to do both if the exigencies of the advancing science of war demanded it, and thus the ocean-going ship-of-war came into existence.

At first her difference from the ocean-going merchantman was not pronounced, as the latter continued to be armed for self-defence through a long succeeding period, on a scale only secondary to that of the true fighter. Many of the Dutch Company's larger ships were in fact included in the battle fleets of the Van Tromps and De Ruyter. But the discrepancy in weight of battery went further and further with the passage of time, and although in the seventeenth century nothing but the true ship-of-the-line had any terrors for the 50-gun East Indiaman, by the middle of the eighteenth even the lightly armed frigate could hold up the biggest merchantman afloat.

With changes in naval architecture went changes in the organisation of the crews; but in that respect efficiency called for unification instead of diversity, and while the number of types of ships was being increased, the number of separate branches in the manning arrangements of a fleet was being reduced. In the pioneer days of Vasco da Gama and Albuquerque the complement of a Portuguese vessel on service in the Indian Ocean comprised three distinct elements. First came the seamen proper, who worked the ship under the immediate orders of the professional sea officer who navigated and handled her. In action with an enemy's ship—or if engaging a shore position under weigh—they manœuvred their own vessel and were all on deck or aloft. In storming a shore position they manned the boats carrying the assaulting forces till the land was reached, and then carried the scaling ladders and incendiary appliances. As body armour hampered their activity, they went into action afloat or ashore semi-naked, and suffered from arrows and all kinds of other missiles that left their armoured comrades unscathed. Next came the gunners, who manned the armament of the ship herself under an officer known as the Constable of the Artillery. These did all the fighting outside close quarters, but they were seldom disembarked, and when a position on land was to be stormed covered the advance of the boats by fire from the ships. Thirdly came the men-at-arms, trained to the use of manual weapons only, who were simply infantry soldiers serving at sea under their own officers. In the gunnery stages of an action these were usually kept well below to minimise casualties; but when the close-quarter stages were reached afloat or ashore, the conflict passed entirely into their hands and they were armed and armoured accordingly. The officers of the three branches interchanged duties much more readily than the men; and in the Portuguese navy—as in all others of the sixteenth century—the supreme command of the ship or the fleet was sometimes in the hands of a sea officer with experience in land warfare, such as Diaz or Da Gama, and sometimes in those of a land officer with an acquired knowledge of practical seamanship. such as Albuquerque or Almeida.

Disproportionately heavy losses among the expert seamen—who could not be replaced abroad—led to the first simplification in the organisation of the Portuguese by amalgamating the seamen and gunners as one branch, the latter having been found to sustain on an average the lowest ratio of casualties. The men-at-arms remained separate, however, for a considerable further period. But in the case of the Dutch and English Companies all three branches were merged from the beginning, and the seamen were not only trained to serve the guns but to use manual weapons as well, while every officer combined combatant duties with a professional knowledge of navigation, so that as occasion required he could con the ship, drill the guns' crews or lead the boarders. Troops were often carried as passengers when attacks on land positions were projected, but these troops were in no sense substitutes for any portion of the regular manning of the fleet, nor was it usual to embark them while the enemy's fleet remained a source of danger, as by unavoidably overcrowding their own ships they impaired their fighting efficiency.

It was under these advancing conditions of naval organisation, both in regard to the vessels and the men, that the Dutch conducted their principal maritime operations in the wars of the seventeenth century; and when they began a regular policy of blockading the chief commercial centres of the Portuguese in the east in 1630, their power on that side of the globe had already risen above that of any existing rival. Before receiving the check which indirectly but profoundly altered the whole subsequent course of history in the east it was destined to rise higher still; for the general political conditions of the world in the second quarter of the seventeenth century were such that no real barrier had yet appeared to prevent the Dutch from acquiring as complete a monopoly of eastern sea trade as that held previously by the Portuguese. Nor did the possibility of a check ever enter at that time into the calculations of the Netherlands Company. So confident indeed were they of their ultimate power to establish a complete dominion over the Indian Ocean that at one critical stage in European politics, when the security of their homeland was

menaced by continental armies, the project was actually mooted of transferring the national seat of government from Holland to Java. The era of Dutch pre-eminence in the east, therefore, may be said to have commenced before 1625. It lasted for about ninety years—which was rather less than that of the Portuguese—and may be roughly divided into three periods of growth, maturity and decline. First came about thirty years of steadily expanding power and wealth, next some forty years of successfully maintained precedence in trade, without further extension of territory; and lastly, twenty of decreasing lead in eastern affairs, at the end of which the British had passed into the premier position in the Indian Ocean.

During the first of these three stages the Dutch Company tolerated no rival flag beyond the Cape of Good Hope except the British; and even that concession was only due to the political expediency of remaining on good terms with the British nation in the unsettled condition of Europe, though they were then feeble at sea. Holding such a position in the east, the Dutch merchants controlled not only the entire trade of the Malay Islands except a very small part, but a constantly enlarging proportion of the trade of the Asiatic mainland also, and with all this in their hands were able to regulate the rationing of the whole of Europe, except the British Isles, in the produce of these distant lands. Save only in north-western India the Dutch ships met the eye in every harbour or anchorage where they permitted the brown man to transact commercial business with the white; and in the places where they chose that no such dealings should take place—as, for example, in the harbours of the Portuguese—the ships remained very much in evidence as the material appliances whereby the prohibition was enforced. All through these twenty-five years of eastern history the Dutch ensign feared no strange sail on the horizon, but every strange sail feared the Dutch ensign between the Cape of Good Hope and the China Sea, unless herself under the joint crosses of St Andrew and St George. Dutch commercial enterprise on that side of the world dwarfed all competition, and to the seaboard populations of Asia the Hollander superseded the Portuguese as the living proof of

European power. At the time of the outbreak of the first Anglo-Dutch war the fleets of the great Dutch organisation counted their ships by the hundred, while those of the London combine were not yet to be counted by the score, and those under the flag of Portugal were scarcely any longer to be seen.

Such was the state of affairs in the Indian Ocean when the seventeenth century had run half its course, and nothing then on the political horizon suggested that Holland should not obtain in time a dictatorship over the whole of its area, as complete as that held formerly by Portugal. But in point of fact a very far-reaching change in the international balance of maritime power was at hand, and only two years later Cromwell challenged the naval supremacy held for a generation by the Dutch. Through the issue of the stubbornly contested battles which then took place within sight of the cliffs of Sussex and Kent, all possibility of a Dutch monopoly of eastern trade based on an assured command of the Indian Ocean vanished; whereby the whole future history of the intercourse between east and west was materially affected. It is true that Dutch territorial expansion on the shores of the Indian Ocean did not at once reach finality, for the conquest of the Portuguese settlements in southern Hindustan followed immediately after. But if the Dutch had gained the upper hand over the British in Europe, there can be little doubt that this conquest would have been carried right up the Indian coast, instead of halting where it did. Indirectly, therefore, the limits of the Dutch possessions, in western India at least, were established by the outcome of this vitally important conflict in western waters, and though their sea-borne trade continued to increase for another generation, the spread of the Dutch Company's property on the land was brought to an end when they turned the Portuguese out of Cannanore.

But the eastern incidence of this war of Cromwell's went far beyond its effects on the Dutch, and indirectly produced a complex situation in the Indian Ocean, lasting till the middle of the succeeding century which was notably different in its main aspects from the situations before and after. The first

contact of east and west existed under the well-established command of the Indian Ocean held by the Portuguese in the sixteenth century; and from the middle of the eighteenth to the present day an equally effective control has been held by the British. But between the two came an interregnum in which nobody exercised a general authority over this great area, though the Dutch were far ahead of any rivals in the extent to which they sailed it. This absence of any supremely powerful flag was caused, firstly, by the preventive effects of Cromwell's maritime policy on Dutch ambitions to succeed to the place vacated by Portugal's downfall; and secondly, by the absence of any such ambitions on the part of the British themselves for the time. As a consequence, all through this period the history of the Indian Ocean loses its previous comparative simplicity and is split up into several disconnected lines of evolution running concurrently; each requiring to be followed separately for a clear understanding of its development, in which process the strict chronological order of events over the whole region has to be set aside. Viewed as a whole the maritime aspects of this stage seem very intricate and even chaotic, but when scrutinised with care and a regard to proportion, the fact emerges that in all the cross currents of a confused general stream, the industrious rivalry of the Dutch and English Companies, though often obscured by side eddies, remained the principal movement; for even if the English were not fired by any aspiration to fill the vacant rôle of dominant sea power in the east, their tenacity in the pursuit of business continued undiminished.

Next in importance to the Anglo-Dutch competition certain other manifestations of maritime activity in varying forms merit attention, as exercising an appreciable though transient effect on the general state of affairs in eastern waters. Thus, for example, we find that several oriental rulers acquired a sufficient degree of naval power to add quite considerably to the tale of sea conflicts in this era of unrest, not only by engaging Europeans but by falling on each other. Arabs attacked Portuguese and Mahrattas. Mahrattas and Moguls attacked British. Malays attacked Dutch. Another point of interest

DUTCH EAST INDIAMAN OF THE SEVENTEENTH CENTURY IN HURRICANE LATITUDES

For 80 years the premier type of ship in the Indian Ocean

(From a sketch by the author)

was the temporary revival of the Portuguese coasting trade through the abatement of the Dutch menace. And a third was the general appearance of piracy in both its western and eastern forms—that is to say oceanic and coastal—to the serious detriment of all peaceable sea industry whether in native or European hands. This noxious development arose simply because neither Dutch, British, Portuguese nor Asiatics had a sufficient interest in the security of the Indian Ocean as a whole to suppress piracy systematically, and each remained content to protect their own shipping by measures devoid of any co-ordination or combined effort.

To trace out these separate factors in the general conditions prevailing in eastern waters during the period now under survey in their proper order of importance, therefore, it is necessary to deal first with the long-sustained conflict of interests between the Dutch and English Companies through its phases following on the earliest of the Anglo-Dutch wars. Before that war the general strategic position of the Hollanders on the Asiatic side of the globe offered many points of similarity to the position held by the Portuguese all through the sixteenth century, though with a different compass direction of outlook. Both arrived in the Indian Ocean by the same route from the westward, but on first entering it the Portuguese had turned north, and after taking up a central position on its northern side, had deployed thence east and west along its shores, with their right wing curving southward through the Malay Islands. The Dutch, on the other hand, had steered across it eastward, and having taken up a central position on its eastern side, had deployed thence north and south with their left wing curving westward along the mainland. Both had the Indian Ocean at their backs in the initial stage of their respective great enterprises, and both looked landward strategically so long as no danger threatened from their oceanic rear. But when that rear became insecure their strategic front was inverted; and instead of facing away from the water they were compelled to turn and face towards it, though their general commercial frontier or line of contact with the Asiatic races remained the same. In the case of the Portuguese this turn about became necessary

when the Dutch and English arrived in the east on the downfall of Spanish naval supremacy; and in the case of the Dutch it followed as a consequence of the first war with Britain. The close of that maritime campaign still left the Netherlands Company with a great preponderance of force east of the Cape of Good Hope; but in Europe the British had the upper hand, with the result that the home end of the only line of touch between the Dutch East Indies and the mother country lay for the time under a suspended sword. Hence it was that although by this time the Dutch Company were maintaining squadrons of regular fighting ships in the Malay Archipelago, Arabian Sea and Persian Gulf, while the London Company had only armed merchantmen, the former were always obliged to regulate their political activities by the knowledge that in the event of trouble with the English in eastern regions, they themselves could hope for no reinforcements from home while their rivals might be reinforced decisively.

Among its other effects this consideration restrained them from carrying their conquests of the Portuguese possessions in south-western India beyond the point at which they might be regarded as approaching imprudently near to the general region which the English Company had made its particular sphere of interest; and it was at Cannanore that these conquests were accordingly brought to an end. Vastly important consequences resulted not long after, for not very far to the northward of Cannanore lay Bombay Island in the hands of the Portuguese; which forms the outer enclosing side of the most spacious and best sheltered harbour in all Hindustan, unhampered by any bar, and open to the arrival or departure of sailing vessels even when the monsoon closes all the ports to the southward. The commercial and strategic potentialities of this fine anchorage had long been recognised by both the rival Companies; but though the island was only held by a few Portuguese soldiers quartered in a defence work overlooking the village, which then stood on the site of the present enormous city, neither had seized it; the English being held back by the obligations of their general understanding with the Portuguese in the east, and the Dutch by having their hands full before the war with

Britain, in consolidating their position elsewhere, and after that war by their disinclination to risk British protests. In 1662, however, this valuable prize—greatly appreciated in the commercial world, though little sought after by politicians—passed under the British Crown by the arrangements for the marriage of a Braganza princess to King Charles II. In reluctantly surrendering it, the Portuguese Viceroy at Goa complained to his sovereign that the foremost strategic position in India was being thrown away; but so little did Charles realise its true value that in 1668 he handed it over to the English Company, by whom it was afterwards made the head-quarters of their eastern administration, in place of Surat.

Three years after the transfer of Bombay to the British Crown the second Anglo-Dutch war broke out, and again the moral effect on the Dutch of their defeat in the first war is traceable in their proceedings. Though still stronger in the Indian Ocean than the enemy, their Company now recognised that the ultimate issue in the east depended on success in the central theatre of operations, which lay, of course, in Europe. Many of their best ships were attached, therefore, as reinforcements to the State fleets in the North Sea—in accordance with a provision to that effect in their Charter—and by this redisposition they were so much reduced in power in eastern seas that their activities on the offensive were confined to the capture of a few small ships and a demonstration outside Bombay. As a large proportion of the British Company's ships were also serving in the war at home Bombay had no naval protection, and if the Dutch had been aware that that island—still a Crown possession at the time—was so weakly garrisoned that the Governor had appealed to the Portuguese Viceroy at Goa for help which was refused, they might perhaps have raided it. But the squadron which made the threat was too small to risk a reverse; and the Dutch knew that if victory attended their efforts on the coasts of England, attacks on Bombay and other ports under the London Company's flag in India might all be taken in hand in due course under an ultimate certainty of success. So Bombay was only threatened prospectively; and as neither the English Company nor the

Crown officer governing the island had sufficient naval force to attack the Dutch colonies on their part, no serious echo of the tremendous struggle in home waters disturbed the serenity of the Indian Ocean.

The Dutch Company lost heavily in ships by this second war through such incidents as "Holmes's bonfire," the popular appellation bestowed on the exploit of that enterprising commander in forcing his way with a few cruisers into a Dutch roadstead and burning 160 vessels lying there in wait for the tide to reach the safety of the inner ports; including the whole annual convoy from the Indian Ocean, which had just arrived in sight of the dykes of Holland richly laden, after their long voyage of nine months. But the wealth of the Company pulled it through the crisis, and the terms of peace left the situation in eastern waters much as it was before, except that the great unexplored island continent of Australia—discovered though not occupied by the Dutch—was ceded to Britain. Important consequences were to result from this four or five generations afterwards; but at the time it meant little, for though Australia flanked the southern extremity of the general Dutch line of front in the east, it offered no potential advantages as a base for an enemy, because at that early stage in the science of deep-water navigation no vessel cared to approach it or leave it except by the Malay Archipelago. Thus in practice Australia was only accessible by a route passing for a thousand miles or more right through the region of the Dutch Indies, where their greatest strength was permanently concentrated and where only Dutch seamen were acquainted with the intricate pilotage. They had little to fear, therefore, from a British Australia till the introduction of great circle sailing long afterwards, by which ships followed the direct oceanic track through the "roaring forties" of southern latitude.

Seven prosperous years for both Companies followed the conclusion of the second war between the mother countries, during which period the Hollanders reached the high-water mark of their prosperity. In spite of war losses some 200 vessels took their orders from the governing council of the Dutch association, inclusive of about 50 regular ships-of-war,

and the clear profits of the shareholders rose to 40 per cent. of their capital. Then Louis XIV of France dragged Britain into a third conflict with the Netherlands in the hope of destroying Dutch independence finally. But though he contrived to gain the assent of Charles II to his schemes this third war was never popular with the British people, who, even if they had little enough cause to love the Dutch, did at least regard them as nearer akin in race and religion than the subjects of the "Grand Monarque." In the immediately previous war France had fought on Holland's side, but now that she was allied with Britain instead, the naval defeat of the Dutch was a foregone conclusion in spite of a remarkably gallant defence. And when at length they were thrust off the sea by weight of hostile numbers their British enemies saw no good reason for not concluding a separate peace and leaving Louis to continue operations by himself if he chose. By prolonging the war single-handed the French King suffered misfortunes on land and sea. On land the Dutch maintained a victorious defence, and in the Indian Ocean a French squadron of six ships-of-the-line specially sent out under Delahaye to attack the Dutch in Ceylon met with utter disaster in spite of some initial successes. These were the first true battleships ever to round the Cape of Good Hope, and thus the expedition, though unsuccessful, indicated a step in the rising importance of the Indian Ocean in European politics. Delahaye captured the Dutch settlements at Trincomalee in Ceylon, and San Thomé on the Bay of Bengal, without much difficulty. But he lost so many vessels by various forms of disaster that he was forced to return home with only one left, whereupon a Dutch squadron retook both places.

Thus the Netherlands Company had the best of such fighting as occurred in the Indian Ocean in their encounter with the French in this war as with their other enemies in the wars which preceded it; and, as the terms of peace once again left them with all their Asiatic possessions intact, none of the prodigious struggles in Europe made any direct or immediate alteration in the political chart of the eastern hemisphere, where for some forty years longer the Dutch retained their

commercial pre-eminence. But cumulatively the indirect effect of these great maritime conflicts of the seventeenth century on the subsequent history of southern Asia was most pronounced, for by exhausting Holland in ships and money they raised the British to the position of first maritime nation in the world, with all the power in distant regions which that implied: a position stabilised by sea victories over the French before the century drew to its close. An effective barrier was thus imposed on further Dutch ambitions in eastern seas, and their Company was compelled to remain content thereafter with the great situation to which it had risen; for the interests of England in preventing the growth of Dutch power in that part of the world was a source of protection to Portugal's trade and colonies as well as those of the British themselves; and, just as the Portuguese in the Indian Ocean had been secured in the sixteenth century by the policy of Spain in keeping naval rivals in check, so now what remained of their former holdings was again secured by a similar policy on the part of Britain in the latter part of the seventeenth.

For about forty years after the third Anglo-Dutch war, however, the Netherlands Company succeeded in retaining the premier place in eastern trade by sheer expenditure of effort, and still employed more ships than their British rivals. But the strain was too much for a small country to sustain indefinitely, just as it had been for the Portuguese before them, and by the first decade of the eighteenth century their finances were becoming embarrassed and their revenue more dependent on the taxation of their colonies than their earnings from trade. Moreover, while Dutch colonial extension had been coming to an end that of their English rivals had been in truth only just beginning, through the founding of trading stations all round the coasts of Hindustan, in direct opposition to the original policy of their Board though ultimately with its approval. Thus Madras grew up round a fort built on a site obtained from a local Rajah after various shifts and trials at other points on the eastern side of the peninsula, and in 1690 the acquisition of another site about eighty miles up the river Hooghly in Bengal permitted of the erection of Fort William,

round which sprang up Calcutta. In this way the British flag was coming to the front as an emblem of territorial sovereignty in the east, while the political power of the Dutch was relatively on the wane; and the opening of the eighteenth century marked the closing chapter of the history of Dutch ascendancy beyond the Cape of Good Hope.

By holding a foremost position in the Indian Ocean for three generations, however, the Dutch could quite justly lay claim to an even more remarkable achievement than that of the countrymen of Vasco da Gama, for it was held under no covering protection from a great Power such as Portugal enjoyed under the Spanish domination of all Atlantic routes. In fortitude, endurance and contempt of danger there was nothing to choose between the early explorers of the two countries, for though the work of the pioneers who sailed from the Tagus bore much the greater fruit, the efforts of those who sailed from the estuaries of Holland to search for northern passages to India demanded fully equal sacrifice. In the spheres of conquest the Portuguese produced the greater leaders but the Dutch the better men in the mass; and the quality of its population in the mass rather than the brilliancy of individual figures fixes the place of a nation in the end relatively to others of the same size. No superiority in wealth or numbers enabled the Hollanders to oust the Portuguese from the foremost place in the trade of the east, still less any advantages in the geographical situation of the mother country. In the latter respect Lisbon had a better position than any seaport in Europe except Cadiz. The success of the Dutch, therefore, can only be attributed to the superior sea aptitude of Nordic blood, against which only another northern nation could hold its own with anything like numerical equality of forces.

In any comparison, however, of the war histories in the east of the Dutch and of their European rivals, it should always be borne in mind that where Asiatic enemies had to be faced the Dutch capital and principal areas of commerce were much more easily protected than those of the British, French or Portuguese. Whenever the active hostility of the brown man

was encountered in his contact with the white the ultimate security of the latter lay on salt water; and as the headquarters and chief possessions of the British and Portuguese in the east were all continental in situation, while those of the Dutch were all insular, the pronounced naval superiority of Europeans over Asiatics conferred defensive advantages on the Hollanders in a far greater degree than on anyone else. Goa and Diu, Surat and Bombay, were each more or less exposed to land attack by neighbours who were formidable on the land, such as the Mahrattas and Moguls. But Batavia, though often enough attacked on its land side by Javanese in numbers, was inaccessible to any of the great military races of Asia except by crossing the sea; and though the Dutch, like the British and Portuguese, had many scattered footings on the coasts of India, these were merely outposts of their general position in the east. The present position of the British in the east is secured by military strength supplementing naval supremacy, on a scale which would be impossible to Portugal or Holland. For want of such strength the Portuguese constantly lost ground under native attack even after the Dutch had ceased to molest them. But as no great efforts on the land were ever necessary to safeguard the Dutch colonies their lack of a large army has not prevented their eastern possessions from remaining intact, except when approached by a European adversary, and their only purely military problems have been concerned with the suppression of internal risings.

As noted on a previous page, developments of other kinds were running their course in the Indian Ocean during the same era; and of these the next in order of importance to the progress of Anglo-Dutch competition was the rise of an Asiatic State on its western side to a certain point of temporary naval importance, as a consequence of the Dutch overthrow of Portuguese sea power. When the disappearance of the fleet once sailing the Indian Ocean under the flag of Portugal enabled the coastal tribes of south-eastern Arabia to expel the Portuguese finally from Muscat in 1650, the ancient maritime position of which the latter had deprived their forefathers was re-asserted by the victors, and a line of Sultans or Seyids rose

as rulers, with seafaring ambitions—chiefly of a warlike description—by whom a fleet of respectable strength was gradually founded. The backbone of this force eventually comprised five large square-rigged vessels of European model—armed in part from the ordnance captured in the Portuguese forts at Muscat—to which were added a numerous flotilla of native craft useful for operations in light winds or shallow waters. With this instrument in their hands successive Sultans of Muscat maintained an attitude of consistent and active antagonism to the Portuguese, the Persians and the Mahrattas of India. Towards the Portuguese this was merely another flare-up of the chronic enmity between the two which had existed ever since the Calicut massacre of a century and a half earlier, always smouldering even when suppressed by force. Towards the Persians their hostility was excited by a variety of causes, racial and religious, and towards the Mahrattas by their revolt against the Mahomedan rule of the Moguls. With the Dutch and British Companies, however, the Sultans maintained peaceful relations, partly because they feared to incur their enmity, and partly because the Dutch were usually hostile to the Portuguese and the British to the Mahrattas.

As the Persians never had any navy in spite of all their wealth, military power and extent of coastline, the Muscat fleet raided their shores with impunity and devastating effect for fifty years, except round the flourishing port of Bunder Abbas, which enjoyed the moral protection of a large Dutch trading settlement. But the Arabs were faced with a more difficult problem in dealing a blow at the Portuguese either on the land or the water. On the water little or nothing remained under the flag of Portugal since the extermination of Portuguese sea trade by the Dutch, and on the land the Portuguese possessions all lay at some distance from Muscat, besides being well fortified. For twenty years after recovering Muscat, therefore, the Arabs confined their activities to harrying the Persian fishing villages; but by 1670 their fleet had reached a point of expansion sufficient for more serious enterprise, and crossing to north-western India on the tail of the summer monsoon, ran into Diu harbour—once a most important naval

base for the Portuguese—where it sacked the town outside the citadel though unable to capture the citadel itself. Thence it sailed on to Daman, another fortified Portuguese town standing on the east side of the Gulf of Cambaya, which was similarly treated. These proceedings alarmed the Viceroy for the safety of his capital at Goa; but either because Goa was too strongly defended, or because they were already overladen with loot and captives, the Arabs steered homewards after ravaging Daman while the winter monsoon was still in their favour for returning.

Forty-nine years were to elapse before the Portuguese, once all powerful in the Indian Ocean, were able to retaliate for these injuries at the hands of an Asiatic sea enemy, and meanwhile the incident depreciated still further their already lowered prestige in native estimation. This aspect of the matter could hardly pass unnoticed by other Europeans in the east; for though the naval weakness of the Portuguese was not brought about by any martial exploits on the part of the brown man, the fact remained that for the first time since the Turkish attacks on Muscat and Aden four generations before, the sea had been no defence to a European flag against Asiatic enemies. If the Portuguese had still been serious competitors in trade the London Company might have regarded their chastisement by the Arabs with a certain measure of complacency; but they counted for nothing now in the rivalries of the commercial world, and the Anglo-Portuguese amity, which had long been a cardinal factor in eastern politics was necessarily affected to some extent at least by loss of political standing to either. This was appreciated at Muscat, where the Arabs were anxious to avoid incurring British resentment. For the next twenty-five years, therefore, they remained content with harrying the Persians, and when next they descended on the shores of India left the Portuguese carefully alone and devoted all their attention to attacking natives.

Meanwhile the confused general situation prevailing in the Indian Ocean was still further complicated by the revolt of the Hindoos of western India led by the Mahratta chieftain Sivaji against the Mogul Emperor Aurungzeb. This rebellion lasted

for many years, and the Mahrattas—who lived near the sea—equipped a fleet of native types with which they conducted warfare afloat in conjunction with their armies on shore. Though never attempting distant oceanic expeditions, the Mahratta light flotillas harried the Indian seaboard under Moslem rule so effectually that the Moguls were compelled to equip adequate sea forces of their own; and between these native opponents the whole western waters of India were kept in a state of incessant unrest by partisan fighting all through the last quarter of the seventeenth century. In the efforts of each to gain the upper hand both expanded and improved their naval forces to such an extent that both became local factors of some consequence in the general maritime outlook, and even attacked European sea interests when circumstances were in their favour. But whereas, in the case of the Moguls, interference with Europeans only occurred when the Emperors were at formal war with the British or Portuguese, the Mahrattas were little better than pirates, whose sole object was plunder and whose hand was against everybody's, whether Asiatic or European.

Though any detailed account of all the conflicts and skirmishes arising out of these unsettled sea conditions would be out of place in a general survey such as is presented here, it will be readily understood that they were detrimental to trade, and the climax was reached in a dispute between the officials of the London Company and Aurungzeb, in which the Mogul followed the example of his brother Moslem of Muscat in embarking on a sea expedition against a white enemy. For half a century or more the relationship between the British and the Moguls had been cordial in general, and the former had even helped the latter to defend Surat against the Mahrattas. But in 1688 the Company appointed Sir John Child as chief factor, who initiated his term of office by a morally indefensible and diplomatically ill-judged seizure of Mogul trading ships in the Persian Gulf for no other reason than their removal from freight competition. This arbitrary and unjustifiable action provoked Aurungzeb to retaliate by imprisoning the Company's Staff at Surat; never a difficult

proceeding, as they lived unprotected within his own city. From that step, however, he proceeded to the much bolder measure of despatching a fleet of 80 native vessels under his Admiral to attack Bombay; to which island the headquarters of the Company had been transferred from Surat three years before. Such an enterprise dramatically illustrated the magnitude of the change in the eastern seas since a few years previously, when the Moguls had relied on the flag of the Company as a protection for Mahomedans on the water; and with it European naval power in the Indian Ocean fell to the lowest point in its history as compared to the contemporary power of Asiatics. Portugal was still smarting under the humiliation of Arab violence at Daman and Diu when for the moment the British centre of administration in the east was menaced from *seaward* by an Indian armament.

For the moment only, however, and to understand the whole position it is necessary in this instance as in so many others to look beyond the immediate point of conflict. Aurungzeb's expedition against Bombay was merely one of the cases in which a local command of the sea has been temporarily established and utilised under conditions of exceptional opportunity. He was doubtless fully aware that Britain was already at war with France and so hard pressed afloat that it was quite certain that neither the London Company nor the Royal Navy could do anything at the time to assist remote British interests which the forces on the spot might be insufficient to protect. The Company's ships actually in eastern waters were very few, partly on account of the situation in Europe, and partly because the homeward-bound vessels for that year had sailed as usual soon after the autumn change of monsoon; which in itself prevented any relief from reaching Bombay till the spring, even if the progress of the European war allowed naval succour to be sent out. In launching the enterprise, therefore, he had little to fear on the water for some months at least, and as events turned out, for more than a year; for the outward-bound ships which arrived in the spring had necessarily sailed from home long before anything was known in England of the Mogul proceedings, and were not enough to deal with

Aurungzeb's numerous fleet in Bombay harbour. But, contrary to his expectations, the small garrison of Bombay fort made such a gallant defence that at the end of a year's siege the flag was still flying, by which time the prospective arrival of further annual ships from London was not far off. And as the Emperor must have known that intelligence of his attack on Bombay had almost certainly reached London before these last mentioned had started on their voyage, he probably anticipated the appearance of a sufficient force to turn the scales against him, if by any chance the course of the war in Europe had moved in a direction more favourable to the British than that of a year earlier, which in point of fact it had. Some such consideration at any rate seems to have weakened his resolve at this juncture, for when matters had reached the stage in question he abandoned hope of capturing Bombay, and in spite of all his efforts and expenditure agreed to peace, on condition that the Company paid him an indemnity of £15,000. This sum was handed over, for even when deposed from a temporary position of supremacy on the water, Aurungzeb was still powerful in the northern mainland of India, where he could always stop British trade if otherwise unable to enforce compliance with his demands. But the lesson was not lost on the rulers of the east, and after the failure of the greatest native autocrat of the age to reduce Bombay, the British Company was never again subjected to wholesale maritime restraint by an oriental sea force, though constantly troubled in a minor degree by the Mahratta pirates, who became more and more numerous and aggressive as the century drew to its close.

It is rather hard to say whether Aurungzeb entertained any hope of permanently annexing Bombay to his empire or not. As a southern base it offered great advantages for prosecuting sea war against the Mahrattas; and even in British hands the anchorage was often used by the Mogul fleet, which led to more than one engagement between these native belligerents inside the harbour itself. But it was obvious that as long as the English Company could always sooner or later occupy it in stronger force than the Moguls, the permanent acquisition

of the port by the latter remained impracticable, even if it fell temporarily into their hands. Its definite addition to Aurungzeb's realms was dependent on such a collapse of the Company as would follow on a decisive overthrow of British naval power by the French; and though the news of the French victory of Beachy Head probably reached his ears, and may have raised his anticipations for a time, it was not sufficiently final to bring about wholesale consequences of that nature. Probably, therefore, his attack on Bombay was aimed more as an act of retaliation with good prospects of spoil, than as an attempt to add the port to his possessions; and in the temporary absence of any effective sea opposition he hoped to deliver the blow without much trouble. In these respects as in most others, the episode bore a close resemblance to the numerous sea attacks on Portuguese fortresses made by Asiatic fleets in the sixteenth century. In every single instance these occurred when the local Portuguese squadron had been withdrawn or reduced below the proper margin of strength, and in all, except the case of Muscat, a relieving fleet saved the defenders before it was too late; though at the Turkish siege of Diu it was not the fleet itself but the mere false rumour of its approach that sent the assailants into hasty retreat.

The next naval moves in the Indian Ocean, of sufficient importance to deserve notice, came from the Muscat quarter, after four years of general quietude, only broken by the chronic strife of Moslem and Hindoo in the waters of western India. As Mahomedans themselves the Muscat Arabs were in sympathy with the Mogul side, and knowing that neither the British nor anyone else would raise objections to a chastisement of the Mahrattas, took advantage of a weak point in their position. The bulk of the Mahratta sea forces were usually kept operating in a region of which the general centre was the vicinity of Bombay. This covered the Hindoo seaports to the southward of that area against an advance down the coast from the northward by Mogul flotillas, but not against a blue-water enemy approaching from the open ocean to the west or south. From this direction, therefore, the Muscat Arabs delivered a series of forays on certain native towns of Malabar, yielding

considerable loot, which the Mahratta flotillas were too far to the northward to prevent. But though effecting a fairly useful temporary diversion in favour of the Moguls by placing the defenders in a difficult position, these adventures produced no permanent political result; and as the coastal population was forewarned by the first attack, those which came later were less profitable in the way of plunder, and less tempting to undertake in consequence.

Other matters, therefore, fixed the attention of Seif-bin-Sultan, the reigning Seyid of Muscat. Inspired by wide ambitions, this capable autocrat had been scheming for some time to use his ships as instruments of national aggrandisement on a more substantial and permanent scale than was possible by ravaging waterside bazaars in Hindustan, though that indeed afforded better practice for his men than they could get in their usual training ground on the shores of Persia. His eyes were fixed on Portuguese East Africa, a much more distant objective than any so far visited by the Muscat war fleet. Political expediency was all against any repetition of his predecessor's attacks on Daman and Diu; but no such consideration applied to Mombasa and its neighbourhood, where Portuguese authority had sunk so low as to excite the contempt of a large Moslem faction ripe for revolt in favour of a revival of the Islamic rule of earlier generations. Less than a single platoon of European troops backed by a handful of native auxiliaries comprised the whole garrison of that part of the Portuguese possessions which lay to the northward of Mozambique, and not a single ship was stationed there.

Though a fair amount of general sea trade passed out from this region its main attractions to Seif-bin-Sultan were the unlimited opportunities it offered him for exporting African slaves to all the Mahomedan countries accessible from the Indian Ocean. On a minor scale this export business already existed at Mombasa; nor was it anywhere regarded in those days as other than a perfectly legitimate and honest traffic, which on the opposite or Atlantic side of Africa reached such proportions in European hands—in order to supply labour for the colonies in America—as to become a constant subject of

international and diplomatic rivalry. By formal treaty rights with Spain the British held the monopoly of Asiento or slave purveyance to the west during a long period; and the Portuguese would have been only too ready to establish a corresponding business connection between East Africa and the nations of Asia, but Europeans were unwelcome traders at the principal markets of Islam. Moreover, the large armed bands necessary for man-hunting in the interior were not available in the African colonies of Portugal, because the Portuguese themselves were too few for the purpose, and the resident Mahomedans too many to be allowed to carry arms without a risk of rebellion. Under the Portuguese rule, therefore, the slave industry made little headway, though subject to no official disapproval whatever.

It was sufficiently obvious, however, that these obstacles to its expansion would disappear if any considerable portion of that part of East Africa which contained good harbours could be brought into Moslem ownership. Such a change could only be effected by force applied in a region remote from Muscat; but the Portuguese defences were weak, the inhabitants largely Arabic in race and sympathy, and the home waters of the Seyid in no danger even from the Hindoos, whose vessels were unsuitable for anything but coastal operations. Having completed his preparations, therefore, by 1698, Seif despatched a squadron composed of all his larger vessels southward early in the winter monsoon, with orders to attack the Portuguese African littoral 2400 miles distant. As being by far the largest organised oversea descent ever delivered by an Asiatic force against a point under a European flag, this enterprise unquestionably holds a notable place in history, to which only the two Turkish expeditions against Diu in the sixteenth century are in any respect comparable, though these had no more than 1600 miles to cover in starting from Aden. And though no Portuguese fleet stood in the way and all the general circumstances were favourable, it must be admitted that the project was a singularly bold conception for an Oriental ruler, which none of the many great Princes of India, or even the Sultans of the Malay Archipelago, would ever have thought of

attempting, with all the horror of the brown man for deep water. It proved that the oceanic aptitude, which distinguished the Arab alone among all the branches of the brown race and gave him the dominion of the Indian Ocean in the middle ages, was still alive in spite of long suppression.

The expedition was successful in every respect. Mombasa, Kilwa and Pemba were all captured without difficulty, and thus the northern half of the very first European possession ever acquired by armed conquest east of the Cape of Good Hope reverted after 193 years to Asiatic subjection, though Asiatics were quite as much aliens on an east African beach as Portuguese. Here again the enterprise is invested with a special historical interest of its own as the only case in history of a definite curtailment of European sovereignty on the shores of the Indian Ocean by an unaided Asiatic sea attack. Ormuz would never have been taken from the Portuguese by Shah Abbas except with the direct and decisive help of a British squadron. The Turkish sea attacks on Diu ended in failure. Muscat itself and the many Portuguese settlements in India lost to native enemies at a later stage all fell before assaults on the land side. The Arab success in East Africa therefore stood in a category by itself. And as far as the Portuguese were in any position to defend the remainder of their territory—lying to the southward of that portion which they lost now—Seif-bin-Sultan's ships might probably have sailed on and seized the whole coastline. But the Arab force embarked to garrison the conquered lands against tribal risings, or the possible eventuality of Portuguese counter-attacks in the future, was too limited to hold a larger area, and Kilwa was fixed as the extreme point of conquest accordingly.

These acquisitions became oversea colonies governed from Muscat, and an Arab maritime sultanate was thus founded on that side of the Indian Ocean which flourished as one till divided up in the latter half of the nineteenth century. It brought evil days on the indigenous natives of equatorial Africa through the great increase of the slave trade which followed in accordance with the hope of the conquerors. By penetrating far and wide inland the Arab raiding bands in time

almost exterminated the villagers over vast tracts of country, under circumstances of indescribable brutality, before British intervention put a stop to their practices in the reign of Queen Victoria, a century and a half later. Opinions differ as to the effect which this had on the subsequent history of Africa, and it is only possible to affirm with certainty that, as the negro is a very prolific breeder when left in peace, the sub-tropical regions of that continent would have been much more densely populated than they are now if the slave trade had not reached the proportions which it did under Arab sovereignty. On the one hand it may be maintained that a larger population would have facilitated the modern development of these lands under European control; but on the other hand stands the belief of some well-qualified judges that an unlimited increase of the negroid races must always be a serious potential menace to the rest of the old world. If such indeed be the case then perhaps the Arab man-seller, in spite of his atrocious methods, was in reality serving the interests of civilisation in a blind and unconscious fashion. Such speculations, however, open up a field of conjecture foreign to the true subject matter of these pages; and here it is only proper to observe that as a result in the first place of the overthrow of Portuguese sea power by the Dutch, some 600 miles of the African seaboard with an indefinite hinterland passed under Moslem dominion with all which that implied. The displaced administration had been the worst of any under a European flag, but with all its faults it was better than that which came after, in its effects if not in its intentions; and the infliction of an enormous degree of suffering on the natives of the soil was among the other direct consequences of the enforced substitution of an Asiatic for a European rule, defective though the latter happened in many respects to be.

This transfer of territory by sea conquest was the last important event of Indian Ocean history in the seventeenth century, and almost coincided with its close. Nothing perhaps could have proved in more illuminating fashion the extent of Portugal's downfall in the east. In the year 1600 that whole Ocean had been in effect Portuguese territorial water from which the Arabs had been relentlessly expelled. But in the

year 1700 these conditions had become so completely reversed that the blue and white bunting charged with the Braganza heraldry was no longer able to protect Portuguese coasts from Arab sea attack, and thenceforward the Muscat slave dhow went freely about her affairs, crammed to the hatches with human goods. For several generations she passed unhindered, as the disinterested idealism which eventually suppressed the occupation of the slave vendor found no official acceptance anywhere till the Victorian age, when Britain alone among Powers with possessions in the east took active measures against it. As the traffic was entirely in native hands and clashed with no European trade it was the only extensive branch of Indian Ocean commerce to remain quite unaffected by the great wars and political changes which occurred during the eighteenth century in eastern as well as western seas. Moreover, the Arab slaver enjoyed certain special immunities in peace, for alone among the larger sails navigating eastern waters she had no interest for the European pirates infesting them from the end of the seventeenth century.

XI

The GENERAL SITUATION in the INDIAN OCEAN DURING the EARLY GEORGIAN PERIOD

THOUGH the eighteenth century was a cycle of great conflicts in Europe from its outset, and proved to be one of the most eventful epochs in the history of the Indian Ocean as time passed on, its early part was marked by a total absence of war on any major scale in eastern waters, which were only disturbed by regional or minor unrest of the sort arising from the enmity between Moslem and Hindoo, and the ravages of piratical adventurers white and brown. It was a period of incessant sea skirmishing, chiefly between Asiatics, but set up no prominent landmarks in eastern nautical history.

As between the representatives of the European nations with possessions or large commercial interests on the Asiatic side of the globe peace remained unbroken for a variety of reasons, till the first half of the century was nearly over. Chief among several contributory causes to this condition of stability stood the anti-French alliance organised to oppose the dangerous aggressiveness of Louis XIV, which included Britain, Holland and Portugal among its partners. This gave a long pause to the formerly incessant strife of white man against white in the east; and other influences tended towards the same result. It happened that these same three had been allied on paper sixty or seventy years before, in joint opposition to Spain; but as the menace of Spanish hostility was not sufficiently threatening to carry this alliance beyond the paper stage in far distant parts of the world it brought no peace to the Indian Ocean, where the officers of the Dutch Company persisted in their sea campaigns against the Portuguese. The new conditions were different, for not only was Louis a real anxiety to the homelands of the allies, and therefore a proportionately cementing influence, but the Hollanders were no longer powerful enough on the water to act in any fashion they pleased, as they had been when Spain was the common enemy. Constant wars had drained away the wealth accumulated while they remained for three generations

in the van of the white man's colonising and maritime enterprise, and their great effort had spent its force. The power to injure Portugal had passed therefore from their hands, and since Portuguese competition no longer interfered with Dutch interests, the wish to injure had passed with the power. As for the Portuguese themselves, they were even less in any position to violate treaties than the Dutch, though their ancient skill with the trident was yet to flicker up once more for a final thrust at an Asiatic sea adversary. Thus the new triple alliance of the Indian Ocean was endangered by no internally disintegrating tendencies like its predecessor; and even if not called into active operation against the general foe, exercised a moderating influence on political rivalry from the mere fact of its established and recognised existence.

For the first nineteen years of the eighteenth century, moreover, no hostilities took place on or across the water between Europeans and Asiatics on any scale comparable to those of the two centuries preceding; not so much because former antagonisms had died out, as because the victors in former conflicts could push success no further without a probability of disaster. Neither the Portuguese nor the Dutch were any longer in a position to engage in wars of conquest against native States; but on the other hand they were not yet so weak as to be unable to defend the territories still in their possession against the sea attack of native enemies, such as Malays or Arabs. These latter, therefore, were disinclined to put the issue to a test, and, seeing no prospect of being able to wrest more coastal territory from the Portuguese after seizing Mombasa, the Seyids of Muscat settled down to make the most of their recently extended domains after their own fashion. It was the same with the Mogul Emperor, whose disputes with the British Company during this particular period led more than once to an internment of their staff at Surat, but whose failure to reduce Bombay had taught him that this island headquarters of theirs stood in a different strategical category. All of which kept schemes of oversea conquest in the background, alike on the part of white man and brown.

Thus the absence of serious disturbances during this phase

of Indian Ocean history was due in part to the political influence of affairs in the west, and in part to a more even balance of maritime power in the east. The turbulent energy which gave rise to the endless conflicts of the sixteenth and seventeenth centuries in Asiatic waters had been generated by the consciousness on the part of attackers of naval superiority acquired by a high degree of commercial prosperity. When the trade of Portugal and Holland declined their fleets declined also. And though a similar condition of prosperity in other hands was destined to breed another series of wars in the same general region at a later date, an interval of half a century of comparative mercantile stagnation had first to intervene. During that period of slackened industry, and partially arrested development in the intercourse of east and west, the flag of Britain alone covered an increasing oceanic tonnage, and even there the advance was irregular and slow. But the movement towards the unrivalled position eventually reached was due, nevertheless, to the urge of forces making progress as certain in the end as may be predicted of any humanly managed process of evolution. Through the decisive naval victories of the seventeenth century the professional competence of British seamen had made all the seas of the world safer for British commerce than ever they had been before; and the business competence of British merchants and their officials on the shores of the Indian Ocean was making now the most of the enhanced security thus afforded to their investments in eastern enterprise. By the second quarter of the eighteenth century the colours of the British East India Company had become the only European symbol of advancing strength and prosperity on a large scale within the range of oriental vision. But they threatened nobody at the time, for the officials over whom they flew were careful to observe the national alliance with Holland and Portugal; and seeking no quarrel anywhere only drew the sword on the defensive against native adversaries. Thus, unless forced to protect itself, the only European organisation of importance at that time with the power to provoke disturbances in the Indian Ocean consistently avoided trouble.

Towards the close of the seventeenth century, the position of

the old London Company had been undermined by the encroachment of other British commercial bodies on its monopolies; but by 1708 it had amalgamated with these rivals, and enough fresh capital had been subscribed to keep it solvent. Since first formed in the reign of Elizabeth, the original syndicate or association had been reconstituted under Crown authority on several occasions, and for some time before the eighteenth century began the purely commercial traditions of its earlier history had been giving place to a new line of ambition, whereby, after the fashion of the Dutch example, the Court of Directors were making the acquisition and sovereign administration of tracts of Asiatic territory a recognised part of their business policy as a source of revenue. The area thus far under their rule was still no larger than some English parishes; but it was the germ of a future empire of almost continental dimensions, sheltered on its seaward frontiers against all enemies by the naval power of its creators. A day, doubtless, did arrive, on which Madras, as one of its chief seaports, had to pay ransom to a French fleet. but it was rescued from a subsequent French occupation, nevertheless, by the terms of a treaty of peace extracted from France by British victories on the sea.

At this same stage of European dealings with the east, when the new policy of the British East India Company was adding territorial ownership to other branches of business, the ebbing dividends of the rival Dutch association were leading to a reduction of the land already under their flag. After the third war with England, the shareholders were unable to raise the capital required to replace their lost ships, and in proportion as their profits on the sale of eastern goods fell off in Europe from lack of carrying capacity, they were less able to afford unproductive expenditure of any kind. Colonial taxes soon remained their sole source of revenue, and colonies yielding neither taxes nor saleable produce had to be evacuated if they cost money to retain. Financial exigencies of this sort called for the abandonment of Mauritius; though the French, who afterwards occupied it for strategic reasons, proved that with sufficient outlay for development the island could be made to pay a good return. So far its history had been uneventful. As

an uninhabited mid-oceanic patch of mountain and forest, devoid of spice-bearing flora, it presented no commercial attractions to the original Portuguese discoverers, and lay too far to the eastward of their normal route to India for any strategic or voyaging advantages from their particular standpoint. They left it unoccupied accordingly. But when the Dutch came on the scene a hundred years later, and selected the Malay Archipelago as a special region of exploitation, the island filled a very useful object by providing a conveniently placed half-way replenishing stage for Dutch ships on the long ocean run between the Cape of Good Hope and the Straits of Malacca or Sunda, whether outward or homeward bound. From the very beginning of their eastward movement, therefore, the Hollanders established there a depôt for fresh water and provisions—including dodo meat—and all through the great shipping activities of the seventeenth century it answered that purpose, though unpopulated and uncleared, except immediately round a group of sheds and store huts at a good natural harbour on the southern or opposite side of the island to its present-day capital of Port Louis. With the number of Dutch Indiamen steadily on the decrease, however, the value of any port of call depreciated as such; and in Dutch eyes Mauritius had no other, for its undoubted strategic potentialities as a naval base south of the monsoon area, and flanking the main route to India, were discounted in their case by the possession of a base even further to windward at Batavia. Moreover, the increase in the size of individual ships, due to the advancing science of naval architecture, had rendered them fitter to undertake oceanic passages without a break, which still further reduced the importance of a half-way stage. By the year 1710, therefore, the Netherlands Company had arrived at the decision that Mauritius was not worth the cost of maintenance, and hauling down the flag, left the island as unclaimed property.

This significant indication of the direction in which the affairs of the Dutch were moving occurred in the far south of the Indian Ocean. But in its northern half contemporary events seemed to promise the possibility to the Portuguese of at least a partial return of their ancient prosperity; for, after some

seventy years of almost completely suspended animation, their coastwise traffic was showing signs of a revival under gradual relief from the active hostility of their former Dutch enemies. Being carried on in small native-manned vessels only, this renewed industry assumed no portentous scale, but brought back a certain degree of life to the long empty harbours of Goa, Daman and Diu, and through its comparative insignificance provoked no opposition or molestation on any side for some years.

But whether waxing or waning in importance, the property of every State, European or native, with interests in sea trade in eastern waters, suffered to some extent during this phase of political peace from the attacks of general though irregular and undeclared enemies. The absence of any strong rule in the Indian Ocean through the successive naval declines of Portugal and Holland did not escape the notice of the lawless elements of the maritime world; and for quite sixty years its highways provided a well-stocked field of plunder for the criminal type of seaman of many widely different nationalities. European and American sea robbers faced the long and hazardous outward passage to fill their chests from the wealth afloat on the far side of the Cape of Good Hope, whether of European or native ownership; and in some parts, where important traffic routes ran parallel to the shore, whole sections of the local Asiatic waterside population developed similar habits, and made considerable stretches of coastline dangerous to approach. As the western pirates necessarily arrived in large ocean-going ships they were able to range over a wide area, but suffered from the lack of any properly equipped refitting base for their vessels, and from tropical epidemics among their men. They operated, in fact, under precisely the usual difficulties of all armed forces, large or small, separated by a great distance from any source of replenishment in men or material, and the careers of individual gangs seldom lasted for long in consequence. But others appeared in their place as they broke up or retreated back to the Atlantic with whatever spoil they had chanced to gather. The Asiatic pirates on the other hand—with certain Arab exceptions—operated in flotillas of small coasting craft unsuitable

for deep-water cruising. These infested only the sea area immediately adjacent to their own territory, and were no danger out of sight of land; but being natives of the locality they were formidably numerous within their own special neighbourhood, and enjoyed the great advantage of secure refitting bases close at hand, besides a comparative immunity from climatic diseases of the kind which kept white piracy under a heavy toll.

In the days of Albuquerque or Coen such seahawks would have found it comparatively difficult to remain for long on the wing east of the Cape of Good Hope. But as no flag held an indisputably foremost position in the Indian Ocean at this stage of its history in any way comparable to that of the Portuguese in the sixteenth, or the Dutch in the middle seventeenth century, none were interested in the same degree in policing it as a whole. For three generations the Portuguese had given up all pretence of acting as general guardians of the eastern seas, and the fleet of the British Company was still very far from being strong enough to succeed to such an exacting responsibility: while the Dutch were barely able to hold down piracy systematically even round Java. No other flag counted for anything, and all remained perforce obliged to protect their own interests by the expedients of the moment. The native rulers, such as the Mogul Emperor, left the native shipping under no protection whatever, except what they could obtain from Europeans in return for permission to trade on shore. Neither the British nor the Dutch governments were prepared at this stage to send out cruisers of their regular navies, partly because they were fully occupied nearer home, and partly because it was considered the duty of their East India Companies to take their own steps in the matter, on the grounds that they were legally permitted to arm their ships. Years passed, in consequence, before any attempt was made to deal with these plagues by an organised offensive of the kind by which the Portuguese had diminished piracy in the days of their sea power in the east.

Under such chaotic conditions the evil naturally flourished. By the end of the seventeenth century as many as ten European or American manned vessels, carrying from twenty to fifty guns

each, were terrorising the coasts of Hindustan, the Straits of Malacca, the entrances to the Red Sea and Persian Gulf, and the Madagascar vicinity of the home route. When commanded by malefactors of such historical notoriety as Avory or Kidd, they not only seized native craft—of which they captured many with valuable freights—but sometimes successfully attacked the large well-armed ships of the European Companies. But the damage they inflicted on British or Dutch interests was by no means confined to the direct loss of ships and cargoes; for by their frequent plundering of native property on the sea they brought wholesale discredit on all Europeans in eastern ports, through the inability of the natives to discriminate between one class of white seafarer and another. It was a frequent custom of these pirates sailing in western-built ships to fly the British, Dutch or French colours as a disguise, and the exasperation produced in the popular native mind against the national bunting of these States by this practice found expression through the Mogul Emperor himself, who warned the officials of the Companies that as vessels under the flags of their several countries were committing acts of war against his subjects on the seas, he would retaliate on those flags at the only points where he could strike an effective blow, that is to say at the trading stations of British, Dutch or French subjects within his dominions. Ignoring their protests he soon put his threat into execution; for after Avory under British colours had captured and looted another Mogul trader, Aurungzeb imprisoned the whole British factory staff at Surat until the Company's President at Bombay had promised compensation and a regular future escort for native vessels sailing to the Red Sea. But the effect of the compact was no more than temporary, for within three years the pirates had again become so aggressive that the Emperor was only prevented from putting a stop to all European business in his territories by a joint guarantee of recompense for future losses on the part of the chief agents of the three nationalities principally interested, and a pledge on their part to take more energetic measures. By this arrangement the Dutch agreed to be responsible for the safety of native traffic with the Red Sea, while the British watched the southern routes,

and the French—whose position in India was becoming increasingly important—attended to the Persian Gulf.

No such schemes, however, stood any real chance of permanent success in the end. It was impossible with the very small number of fighting ships proper at the disposal of the Companies to organise any efficient system of convoys, and freight carriers could not be spared for sea police work. For a third time, therefore, Aurungzeb applied pressure from his side, and now more drastically than ever. Maintaining, not without some reason, that Europeans should restrain the violent practices of their own countrymen on the element where the white man was supreme, he stopped all European trade under whatever flag within his Empire, and confined every white man at Surat within the walls of his own particular national enclosure. To this the British and Dutch sea commanders replied by blockading Surat to seaward and thereby stopping all native export as well. In this particular quarter of the east, therefore, a most peculiar situation arose. European supremacy afloat remained unchallenged by Asiatics, who, unless in overwhelming numbers, were unable as ever to face an armed ship with white men at her guns, whether these were reputable or criminal in character. But the power of Europeans on dry land was almost negligible when compared to that of a potentate such as Aurungzeb, and their dominion over the Indian Ocean was proving unable to control its own vices. As a consequence Asiatics strangled European commerce ashore, and Europeans strangled Asiatic commerce afloat, each on account of the misdeeds of a common enemy detested by both.

The sea blockade of Surat, however, was not much more than a gesture of protest, as the ships were required for loading at other ports where no embargo existed, and were soon withdrawn. But the incarceration of the European elements in Surat within their own concessions remained in force for several years, during which time all trade between the Companies and northern India was suspended. On the whole, perhaps, the Emperor had the more reasonable arguments on his side; but whether that was so or not, he certainly occupied the stronger position in the dispute, as the eventual outcome was to prove, for his

unrelaxing attitude produced reiterated appeals to the home government by the British Company to send out ships of the Royal Navy and end the deadlock by suppressing the pirates, which at length received some attention. Even then the number of cruisers despatched was too few for decisive results, but the fact of their arrival in the Indian Ocean did at least make the pirates more cautious and to that extent improved the situation. It was not, however, till as late as 1722 or thereabouts that they found the Indian Ocean too hot to hold them, and abandoning the base which they had used for many years in a remote harbour in Madagascar, dispersed and ceased to be any longer a source of serious complaint on the part of eastern magnates against western flags.

But in addition to the white pirates were the local or coloured, who within certain areas were quite as noxious, although of course their ravages brought no odium on Europeans. These belonged to several races, and in some respects were even more difficult to deal with than the others, not only because in their case piracy became almost a national occupation—which as natives of the east they could follow on the spot in thousands—but also because they possessed all the advantages attending on an armed force which operates close to secure retreats and ample sources of supply. Such were the Muscat Arabs, the Sanganians of Cutch, and the Joasmi of the Persian Gulf. But foremost of all stood a section of Mahratta breed, who took to the water in a local and limited sense during their revolt against the Mogul dynasty, chiefly in the type of coaster known as the galivat: a lateen-rigged craft of moderate dimensions resembling a Sicilian felucca, fast and handy under oars or sail, but an indifferent sea boat in heavy weather. When light winds or calms made escape impossible and manœuvring difficult for a large Indiaman the galivat had her opportunity; and an attack by a whole swarm of these wasps generally ended in tragedy if the defenders ran out of ammunition, as sometimes occurred.

Among other highly competent and energetic leaders who came to the top in the long Mahratta rebellion was Kanaji Angria, a man of obscure origin but outstanding power of command, who established himself as an independent chieftain

in a series of strongholds—said to have been first granted to him for services in war—along a stretch of about 130 miles of the coast immediately to the southward of Bombay, whence he overlooked a main artery of sea traffic under European and native sails. As head of a following who only existed by the sword, the chances of loot led him afloat; not very far and never in stiff weather, but quite far enough and often enough to introduce a new and most disturbing element into the sea area covering the approaches to the chief European trading centres in western Hindustan. Thenceforward his career was devoted to sea plunder as a methodical industry, with such success that the adventurer of humble birth not only amassed sufficient wealth to found and maintain a realm repudiating any allegiance to a higher lord for half a century—which was passed on to his sons—but actually left a more conspicuous name in the salt-water annals of the east than any of the great dynastic rulers in the history of Asia excepting Kublai Khan.

The fortress capital and fleet headquarters of this prince of marauders stood at the port which in those days was generally called Gheria—but is now known as Viziadroog—at the mouth of one of the numerous small rivers flowing down from the Western Ghats. Before actually reaching the sea this stream turns sharply northward and runs nearly parallel to the shore for a short distance, thereby leaving a narrow tongue of land between the estuary and open water, which gives extreme natural strength to the position. On the tongue stands a ridge of rocky heights, so that vessels lying inside are screened from seaward and effectually protected against the fire of any attacker who may be unable to force his entrance into the river itself. To prevent such an entrance a strongly armed citadel was built on the ridge, with a wide arc of fire and observation; and, moreover, as only the Angria pilots were acquainted with the navigable channels in the inner reaches of the estuary, no enemy could follow them far up stream even if he succeeded in breaking in below. So formidable was the problem of reducing this almost inaccessible seat of power that for fifty years it was never seriously contemplated; and within its shelter the Angria fleet increased and improved till it became a model of predatory

organisation, with soundly-built vessels, serviceable armaments and well-equipped dockyards staffed by competent shipwrights. Subsidiary bases for occasional anchorage were established at the mouths of two or three other rivers rather farther northward on the same coast, into which the light draught galivats could slip without any fear of being followed if beaten off or chased by a European ship. Of these the principal was Severndroog. As in the fleet of the Seyids of Muscat, service under Kanaji attracted followers from reckless and renegade Europeans in eastern seaports by the prospect of booty and good pay for skilled hands; in addition to whom a certain number of white prisoners were usually employed on compulsion in his dockyard.

If the Angria adherents were under the influence of any special religious or racial bias their chief antipathy was probably directed against Moslems: but such feelings counted for little in practice, and any vessel under whatever flag or ownership heaving in sight of their watch towers had to be prepared for trouble unless there was plenty of wind In course of time their flotillas became such a terror to native traders, and such a source of anxiety to white, that the former kept a hundred miles to seaward of the land between Colaba and Gheria, and the latter found it advisable always to cross this danger zone in convoy. It was chiefly to protect their interests against the Angria menace that the British Company established a small war squadron of their own—apart altogether from their fleet of regular freighters—composed of a few corvettes, sloops and native types, all built by local labour at Surat or Bombay. This squadron was the force known at one time as the Bombay Marine and later as the Indian Navy; never more than a small organisation at any time but with a very fine record of service. It soon earned the wholesome respect of Kanaji's galivats outside Gheria or their other fortified retreats, though never strong enough to reduce their main shore defences, which were only battered down eventually by ships of the line belonging to the Royal Navy many years later.

Another important, but very different branch of oriental pirates, were the Arabs of Muscat When their fleet had ousted the Portuguese from as much of the East African coast as they

themselves required for the slave trade no other promising field for expeditions of that kind remained. As an outlet for their energies, therefore, and a source of general profit, they seized anything afloat on which they could lay their hands without incurring serious risk. Like the Atlantic type these were blue-water bandits who despised coast hugging; and whereas their rivals and deadly enemies in the Angria fleet were always loath to find themselves more than fifty miles from a secure home anchorage, the big Muscat gun-dhows thought little of sailing two thousand, and might be encountered well out of sight of land anywhere between East Africa and the Bay of Bengal. The Mahratta breed, in fact, resembled the Turks in being more ready to face the risks of the sword than the risks of drowning, except for good plunder within easy reach. But though far bolder and more enterprising as seamen, the Arabs were much less venturesome than Angria's men in selecting their objects of attack, and very seldom had the temerity to molest any European flag but the Portuguese. As their main squadron of European-modelled ships was kept near Muscat for defence, their piratical cruises were usually undertaken in the stout teak-planked type of dhow known as a buggalla, which not only carried a sloop's full broadside armament but could face any weather, and had the heels of most square-rigged vessels except in a gale.

Against the Portuguese the enmity of the Muscat Arabs was not only traditional, but could find some scope owing to the naval weakness of Portugal. When, therefore, the coasting trade between Goa and other points began to revive early in the eighteenth century—as already mentioned—the Muscat cruisers made it their special object of attention, and thereby in time drew down upon their own heads the first noteworthy naval operations of that century in eastern seas. Having insufficient naval protection, and no ports of shelter in the Indian Ocean away from western Hindustan, a number of small Portuguese traders were captured. This was the first move, compelling the government at Goa to take some action or lose a returning prosperity. The Viceroy seems to have believed—or affected to believe—that the officials of the British Company had a hand in

these proceedings, perhaps because the Arabs were shrewd enough to leave British ships entirely alone. He even went so far as to accuse the Company of selling arms, lending men and supplying British papers to the Seyid's fleet as a safeguard; possibly in the hope of raising trouble between Bombay and Muscat But the Company's President denied all such charges and declined to take any steps.

Finding in consequence that if he wished to put a stop to these losses he must rely upon his own efforts, the Viceroy proceeded to raise the necessary sea forces. In the days when the Dutch were powerful and jealous of Portugal they would have prevented any such proceeding; but those days were past, and when peace reigned among Europeans in the east no Asiatics could prevail against even the feeblest European flag in deep water It so happened that local resources were equal to the requirements of the Portuguese situation. Native shipwrights had long since learnt to build excellent teak ships from western models, and lascar seamen of sufficiently good fighting quality for service against an Asiatic enemy were obtainable in Surat and Malabar. From such sources a squadron officered by whites was eventually created to defend the Portuguese merchantmen against Arab depredations. So well did it answer its purpose that before very long it turned the tables on the enemy and passed from defence to attack. Its efficiency—relatively to native standards—in the course of time attracted the notice of the reigning Shah of Persia, whose coasts had suffered from the Muscat fleet for fifty years in impotence, and who now suggested to the Viceroy that Portuguese and Persians should combine to break up the Seyid State by taking Muscat itself. The division of responsibility was to be the same as that proposed by Shah Abbas to the English East India Company of nearly a hundred years before, when inviting them to co-operate in taking Ormuz from the Portuguese; that is to say, Persia would provide an army if the European partner to the scheme would provide a fleet.

This project found favour at Goa, especially as it was to be understood that when taken Muscat would revert to its former Portuguese ownership, for the Shah professed that for his part

he would be satisfied to see the obnoxious Arab dynasty expelled. The Viceroy lacked the necessary land force to embark on such an enterprise single-handed, but he was quite prepared to send his fighting ships to deal with the Seyid's fleet and clear the way for the passage of the promised Persian troops. A bargain on these lines having been struck, the Portuguese-Indian squadron sailed from Diu on the autumn change of monsoon in 1719 to fulfil its share of the contract, in the execution of which it fought the first Indian Ocean general action of the eighteenth century, and achieved the last notable success of its country's record in the seas to which Vasco da Gama had led the fleets of western civilisation.

Though never at peace with the Muscat Arabs, the Portuguese had been so decisively weakened by the long series of Dutch attacks in the seventeenth century, that sixty-nine years had elapsed since their last engagement with an Arab fleet. On that occasion the enemy had lost little time in retreating under the protection of his heavily armed forts on shore; but in the interval the new Muscat navy had come into existence, and this time the Moslem admiral accepted battle in the open sea. It is to be regretted that no detailed lists of the contending forces in this highly interesting encounter has survived, but the readiness of the Seyid's ships to meet the issue warrants the belief that in total weight of metal they were at least not inferior to their adversaries. In the matter of the men behind the guns little difference of quality existed, both fleets being manned by Asiatics with a small stiffening of Europeans of mixed nationality, but in the matter of officers those on the Portuguese side were all white, while those on the other were all orientals. History has repeatedly proved that where other things are equal, a force under European leadership is more than a match for a force led by Asiatics, and on the water, at least, not one single instance to the contrary ever stood on record till the rise of modern Japan. The rule held good on this occasion as on all others; for though the Arabs offered so stubborn a resistance that in spite of three days' fighting the first engagement remained indecisive, they became demoralised under the strain of a renewed attack—delivered after an interval of temporary

exhaustion on both sides—and went so completely to pieces that only a remnant escaped. In the absence of any account of the movements producing this result we should probably be justified in supposing it to have been due to the superior manœuvring of the victors; for even if the Portuguese officers of that generation were without any experience of squadron tactics, it seems reasonable that they should be credited with a share of the tactical sense inherent in European seamen as contrasted with any eastern race of nautical traditions. European standards of discipline are likely also to have contributed to success.

In so far as it deprived the Arabs of power to do further injury to Portuguese sea trade, this victory was not without its important consequences. But it was barren of fruit as regards the more immediate and declared object of the whole enterprise—that is to say, the recapture of Muscat for Portugal—through the bad faith of the Persian Shah. Europeans were long in learning that little trust could be reposed in the pledges of Ispahan if the obligations attached to their observance could be safely evaded, and history was once again repeating itself. In the early seventeenth century the head official of the London East India Company at Surat found that the facilities for trading in Persia, promised by Shah Abbas as a condition of the Company's assistance in taking the island of Ormuz, came to nothing when the ships had done their work; and in the early eighteenth century the Viceroy of Goa underwent a like experience, for when the sea power of Muscat had been broken the guaranteed Persian army was not forthcoming. In both cases an astute and unscrupulous follower of the Prophet had made a catspaw of Europeans by inveigling them into a compact, in which the white man's share of the task had necessarily to be completed before that of the Persians could even be commenced; and in both the latter defaulted when their own ends had been secured. When, therefore, the Portuguese admiral had freed the coasts of Persia from any immediately further fear of the Muscat raiders, and announced that he was ready to embark the promised Persian troops for the attack on the enemy's capital, he received no reply; and finding that all his

representations in the matter were ignored, returned to Goa in disgust on the change of monsoon.

After this success over the Arab fleet the Portuguese could unquestionably have retaken their lost East African possessions in so far as any opposition on the sea was concerned. Nothing left afloat under the Seyid's flag could have prevented it, and as neither the British or Dutch ever evinced much interest in the ownership of a region so devoid of commercial opportunities as compared to India or the Malay islands, no obstruction was to be apprehended from that quarter. But in addition to a fleet, a sufficient land force was necessary here to overcome the numerous and well-armed Arab population which had settled in that region during the twenty years elapsing since its conquest from the Portuguese; and as the constant danger of attack by the native States on the land frontiers of their Indian possessions made it impossible for the Portuguese to spare a single soldier from their Indian garrisons, such a force as was required to retake East Africa could only be supplied from the mother country. To this costly alternative the prospective advantages to be gained were hardly commensurate. Mombasa and its adjacent littoral had not been occupied by the early Lisbon pioneers in any hope of founding a lucrative export business, but in order to prevent their uses as points at which hostile native craft could lie in wait for Portuguese ships on the main route to India where it passed close to the African shore. But as the traffic using this route had been practically confined to British and Dutch vessels for sixty years—which were well able to look after themselves—such a consideration had no longer any weight for Portugal; and no national interests remained to be served by an expensive military undertaking involving the maintenance of a perpetual garrison in a region not rich enough in itself to meet the outlay. No re-assertion of Portuguese sovereignty over this region was therefore attempted; and in spite of the long-continued piratical propensities of the Seyids of Muscat, the domains over which they ruled in the eighteenth century were left in their possession, and handed on to their present-day descendants.

A different fate was in store for the pirate State founded by

Kanaji Angria the Hindoo, which, though tardy in its fulfilment, afforded an instructive illustration of the white man's power in the Indian Ocean, and perhaps even more of the considerations which guided him in exercising it while still in the earlier stages of the process of extending and developing the contact of east and west. In our own age these considerations accept certain moral obligations towards humanity in general which have no connection with self interest; as, for example, the forcible suppression of piracy and slave dealing, even when not directly injurious to Europeans. But in the early eighteenth century no such altruistic principles played any part in eastern seas, where the only motive inspiring the activities of the white man—or any other man—was the gain of wealth. Hence it was that the Sultanate of Muscat was suffered to continue in existence while the Mahratta pirates were eventually stamped out. Two severe lessons at the hands of the Portuguese, though separated by an interval of seven generations, had proved to the seafaring Mahomedans that the flags of all Christian nations must remain unmolested when afloat, even if they had their periods of semi-eclipse; and though the people of Muscat still remained pirates and slave dealers in principle and practice for another century and a half, they were astute enough after their second chastisement to harass native shipping only, with the safety of which the white man made no pretence of being concerned, except when paid to protect it by some such native sovereign as Aurungzeb. In the eyes of Europeans of that period the Arab pirate might be a beast of prey for all they cared, so long as he remained harmless to domestic stock. Perhaps he even served a certain useful purpose in preventing other game from over-running good pasture. But the Angria species was the sort which prefers raiding the flock to anything else, and had to be exterminated when the means for a successful hunt could be organised if there was to be any permanent security. Until too late to profit by it he never suffered penalties for his misdeeds of a kind which instilled caution; though, considering his nature, it may possibly be doubted whether any lessons would have convinced him of the ultimate consequences of his proceedings. Such experiences

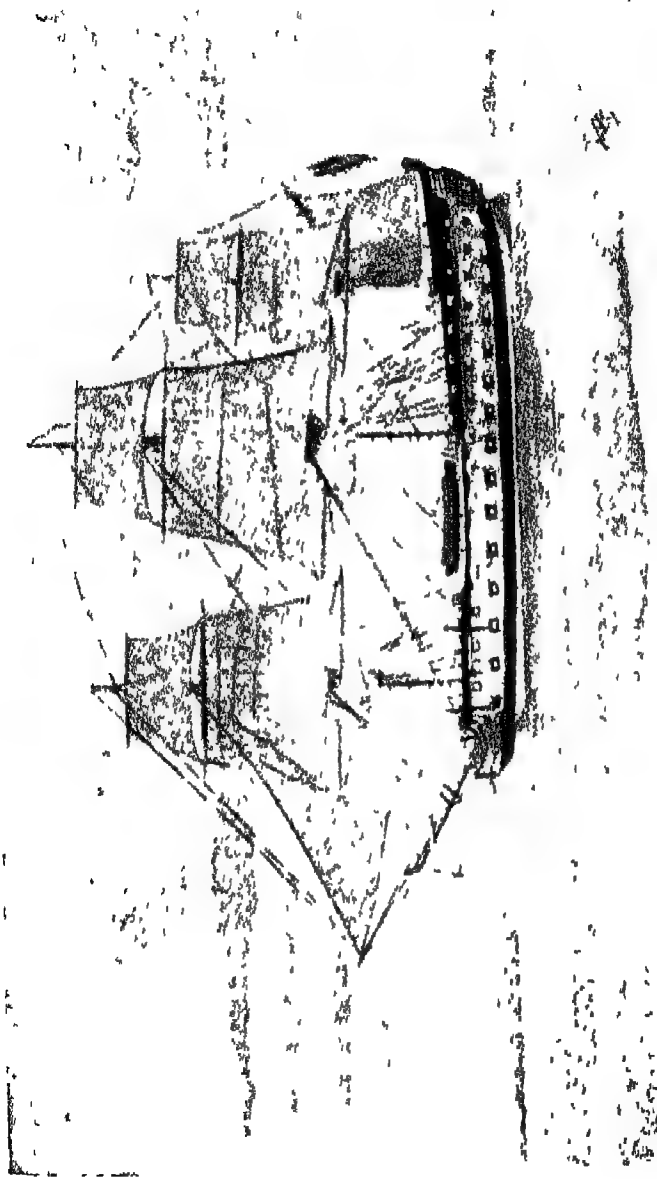
indeed as fell to his lot were rather of a character to teach him the opposite, and his long immunity from retribution only served to increase his self-confidence.

When Kanaji died in 1730—or thereabouts—his sons fought over the inheritance in true oriental fashion, and to some extent divided the father's foreshore possessions. But all carried on the paternal occupation in greater or lesser degree; and, moreover, through maintaining an intransigent attitude towards the paramount Princes of the Mahrattas, created enemies for themselves on their inland frontier in a way which made them more than ever dependent on gathering spoil from the sea But although without friends in any direction, so great was the reputation of their strongholds for impregnability, that for a full quarter of a century after Kanaji's death neither European nor native sufferers by their ravages were prepared to attempt their extirpation; and all submitted to the burden of such purely passive measures as convoy or patrol by specially maintained sea forces as a defence. It was not till 1756, therefore, that the crushing of these long irrepressible menaces to the security of traffic in the waters of western Hindustan was taken in hand; and even then only because other and much more important events happened to bring sufficient naval power to the spot for the work. By its extension to the east, the mid-century rivalry between Britain and France resulted in the despatch of regular battlefleets to the Indian Ocean for the first time; and in 1755 Admiral Watson, the British Commander-in-Chief, having arrived at Bombay with no other immediately urgent service in hand at the moment, assented to a proposal of the President of the British Company at Bombay for reducing Gheria by a combined expedition of the Royal Navy and the ships and troops of the Company. Severndroog—the lesser of the two principal Angria sea fortresses—had already been reduced a few months earlier by the Company's forces unaided, but Gheria was more than they could attempt. When all arrangements had been completed, Watson sailed accordingly from Bombay early in 1756 with a joint fleet of three sail-of-the-line, eight frigates and sloops, and some bomb ketches. Embarked on board the ships were 1400 European and native troops under Colonel

Clive, who afterwards became the most celebrated figure in Anglo-Indian history. On arriving off Gheria, the troops were landed to seize the neck of the ridge on which stood the citadel, the liners brought their heavy armaments to bear at close range on its sea face, and the smaller vessels forced an entrance, and attacked the Angria fleet lying in the harbour behind the castle before they could escape up river. When two days' bombardment had reduced the walls to rubble and the ships to wrecks the fortress surrendered and the Angria rule of nearly sixty years of organised sea pillage came to its end. By the terms of a previous promise Gheria itself, and Toolaji Angria its chief, were both handed over to the Mahratta realm.

This affair bore a certain historical interest as a portent of what was to come. Though still entirely under the influence of self-interest, Britain was making an initial move towards the reign of order and security benefiting all peaceable sea avocations, which she afterwards extended to the whole Indian Ocean when her supremacy in all the seas of the world became an established fact But viewed in their true proportions the ravages of pirates, and the conflicts described above in which Asiatic belligerents formed one side or both, were no more than squalls in the eastern maritime situation of the eighteenth century. Great international gales never arose there unless Europeans were opposed to each other; and, as already mentioned, the three western nations principally in touch with the east at the close of the seventeenth century were in a condition of mutual and stable peace. British, Dutch and Portuguese traders sailed fully armed, but not to cross swords among themselves, and when they passed at sea exchanged salutes instead of broadsides. Nor was it until the intrusion of France as a fourth rival for power began to loom large, when the eighteenth century had entered its fifth decade, that this atmosphere of political calm became unsettled: to be succeeded by several periods of violent strife. On two important points the renewed struggles of white man with white in the Indian Ocean differed in character from their earlier conflicts in the same area, for they were now to be waged by Crown forces instead of privately owned ships, and inspired quite as much by political as commercial ends. Thus

the new sea wars of Europeans fought under the eyes of Asiatic spectators were greatly to transcend the old in scale if not in spirit, and excite the interest of the onlookers in proportion. Giants entered the ring where only light-weights had contended before.

With the passing of the day of small States in the Indian Ocean passed also the rule of the smaller types of vessels upholding it. Caravel, galleon, Indiaman and frigate had all been familiar objects at one period or another in eastern waters, but these instruments of power and their traditions faded into insignificance with the advent of whole squadrons of two-deckers. When Delahaye's division appeared on the coasts of Asia two generations previously, the east had a brief glimpse of earlier models of these majestic specimens of the shipbuilder's skill; but owing to the miscarriage of his expedition through bad seamanship the impression left on the native mind by their size and armament had been merely fleeting. When France and Britain, however, began struggling for the mastery of the sea approaches to their respective centres of trade and government in the Carnatic provinces of Hindustan, Asiatics had visible proof that all former standards of power as represented by naval architecture needed revision, and that the last word in any altercation afloat lay in the annihilating metal of the ship-of-the-line.

BRITISH SEVENTY-FOUR OF THE LATE EIGHTEENTH CENTURY

(From a sketch by the author)

XII

The FIRST and SECOND ANGLO-FRENCH CONFLICTS in the INDIAN OCEAN

THE narrative of the principal naval operations in the east during the eighteenth century affords one of the best illustrations in history of the processes whereby the installation of a trans-marine sovereignty, such as the British rule in Hindustan, alone becomes possible in the face of hostile and formidable competition. For British readers, therefore, the story possesses a special interest; all the more because many features of the general situation in the Indian Ocean of our own time, with their bearings on vital problems of Imperial defence, remain almost precisely as they were left by the outcome of the great wars of the later Georgian era. To those, however, who are unversed in that branch of national history in which oceanic problems play an essential part, it may perhaps be useful here to preface a narration of the story itself by some exposition of the reasons which have so often invested warfare on the sea with decisive consequences for political, military or commercial situations on the land. Any student of our national past knows that the struggles between British and French on the soil of India were accompanied by exchanges of heavy blows on the water; but for some the precise connection between the operations on one element and those on another remains ill-defined. It is to remove any obscurity in regard to first principles in this matter that the remarks immediately following are intended.

A professional writer is often assisted to explain his subject by instancing some analogy or simile borrowed from the field of familiar general knowledge, and it so happens that a very modern parallel of this kind can be used with advantage in treating of the Anglo-French fights for India. The man of ordinary education who moves in the world of to-day, for instance, can hardly fail to be acquainted with the elementary facts connected with the application of electrical energy to a host of different requirements. He knows that the energy or current is created in a power house and carried thence by cables to the point at which the work is to be done, whether

in driving trains or tramcars, rotating factory machines, lighting towns or effecting other public purposes. If the power house plant breaks down everything stops. If the transmitting mains or cables are cut the work at the business end is suspended for lack of driving force. Sometimes the cessation may be delayed where arrangements exist for accumulating a reserve of energy on the spot, but that is only a respite, which can merely keep the wheels going till the reserve energy has run down. And, if the machinery which is actuated by the energy conveyed through the cables is defective in itself, the work remains unexecuted, even though the power house and cables are operating properly.

Each section of this apparatus designed to function as a whole for a specific object has its precise counterpart in the founding and maintenance of a rule in a region separated by the sea from the ruling State. The power house is the ruling State itself, whence emanates the energy. The energy in this case takes the shape of troops, arms, money and supplies; and the transmitting cable is the sea route along which these are carried to the point where they are to be applied to the industry of government. All three sections of this united organisation must be maintained efficient for that industry to exist. If a rival State with ambitions in the same region can defeat the ruling State in the latter's home territory, then the power house has been wrecked and everything collapses with it. Or should the rival get the upper hand at sea sufficiently to prevent the passage of troops and supplies to the coveted region, then the supply main has been cut, and the consequent deprivation of energy brings the work at the far end to a standstill sooner or later. The stoppage may on occasions be immediate; but sometimes the men and materials already at the far end represent a sufficient reserve of accumulated force to keep the machinery revolving for a while without fresh current. Should the loss of sea command be only temporary, this stored energy may perhaps suffice to carrry on the work till the sea command has been regained; which would mean, of course, that the severed transmitting cable had been rejoined and rendered fit for use again. Finally, if the men and materials sent out fail to hold

their own against those of the rival State on the spot, then the factory machine is at fault, even if the power house and cable are performing their shares satisfactorily.

It will be seen that the division of responsibility, therefore, is threefold. The duty of the administrators of the ruling State —or mother country—is to see that the power house sends off an adequate supply of energy and is protected against rival violence. The duty of the seamen is to keep the transmitting line intact, and in time of war to cut the line of the rival concern. The duty of the officials at the far extremity is to make the best use of the power it conveys to their hands against opposition and competition on the spot. Speaking generally, the Dutch were the first to understand this doctrine as a nation, although from his writings Raleigh seems to have been the first as an individual. By the Netherlands East and West India Companies it was systematically and successfully applied all through their long wars with the Portuguese in Asia and America. Cromwell evidently regarded the Dutch example as sound from his method of waging war against Spain; but it did not become the established model for the distant war strategy of England till the middle eighteenth century. Many French officers displayed an instinctive perception of the principles involved—such as Montcalm in the west and La Bourdonnais in the east—but few French governments comprehended them more than imperfectly. Clive appreciated them clearly, while Dupleix failed to recognise them at all.

Though all three spheres of labour as detailed above were equally necessary for the success of the whole, it is only with the responsibilities and work of those engaged on the central section that this treatment of the subject is concerned; that is to say, the seamen entrusted with the preservation of the lines of communication which represented the conveying cables of military and commercial energy for their own country, and the destruction of the similar lines of the enemy. And more especially still, with those whose duties lay near the further extremities of those lines in the Indian Ocean. They were the longest of the important routes of communication in use in the whole earth at that period, and proportionately vulnerable

in consequence; and during the three Anglo-French wars which spread to India it was usually the home end of the British line that was the better guarded and the far end of the French. Sometimes both of these metaphorical power cables were functioning in competition, at others both were cut: but a full account of their attack and defence throughout their length would entail a description of naval movements in European waters outside the proper geographical scope of this survey of events. Only occasional reference will be made to operations outside the Indian Ocean, therefore, where essential to a complete presentation of the general situation.

The war of the Spanish succession, in which Britain and France were involved as enemies, came to an end in 1713. Owing to the naval weakness of France, it never extended to the Indian Ocean, where its only effect had taken the form of uniting former rivals, not from apprehension of any danger to their interests in the east, but as a result of the defensive alliance of the mother countries in Europe. That war was followed by peace lasting for a full generation, through the determination of Walpole and Fleury to maintain amicable relations between Britain and France; so that men who were in their childhood when the lull began grew to maturity without knowing what war meant. During this long silence of the guns the steady expansion of the British East India Company left the Dutch and Portuguese far behind in political and commercial influence in Hindustan; but the French Company—hitherto an insignificant factor in eastern longitudes—had been amalgamated with the French West Indian concern, and in its enlarged constitution was making great efforts to rise to a position of importance in Asiatic trade. Two years after the war of the Spanish succession, the governing board made a well-judged move towards establishing a firm footing in the Indian Ocean, by appropriating the unclaimed island of Mauritius; which gave the Company for the first time an eastern harbour suitable as a naval headquarters in war, from its windward position during the season of the summer monsoon in Indian waters. For a good many years they left Mauritius comparatively undeveloped from motives of

BERTRAND FRANCOIS MAHE DE LA BOURDONNAIS
French Naval Squadron Commander and Governor of Mauritius

economy; but in 1735 appointed Commander Mahé de la Bourdonnais, of the French navy, as Governor; under whose competent and vigorous policy a fortified naval base was created at Port Louis on the north side of the island, with equipment and resources second to none in the southern part of the Indian Ocean except Batavia. Bombay was at that time the only British harbour in Asiatic waters suitable for the headquarters of a fleet in war; and thus, after Port Louis came into existence, the respective naval centres of Britain and France in the east faced each other north and south across the Indian Ocean, at the easily traversable distance of only 2500 miles.

La Bourdonnais began his career as a merchant seaman before receiving a naval commission, but he was endowed with a natural comprehension of large strategic problems, and realised the important position which Mauritius must occupy in any future war with England. As an officer of wide outlook his grasp of the situation not only covered the Indian Ocean—where he perceived that British interests had very little local protection—but reached back to the home end of the long line of communication; recognising, as he did, that even in the east the final outcome of such a conflict would depend less upon what happened in the neighbourhood of the Bay of Bengal than what happened in the neighbourhood of the Bay of Biscay. And as the British navy counted about ninety sail of the line to the French forty-five, he suffered himself to entertain no false hopes as to the probable fate of the French position in India by the time a war with Britain came to a finish. When, therefore, a conflict broke out between Britain and Spain in 1739 as a result of commercial disputes in the Caribbean, which seemed likely to involve France on the Spanish side, La Bourdonnais spoke his mind to the authorities in Paris as to their best line of policy in the Indian Ocean. While declaring that they had little chance of permanently holding their own in the Indian peninsula, he pointed out that if they despatched a squadron to Mauritius in readiness to act with promptitude on the outbreak of war, before British naval superiority had time to extend its long arm, they might seize a large amount of valuable and removable British property in the form of ships, goods and

bullion. This was obviously not a scheme of the dramatic and ambitious sort which aims at changing the map and appeals to the French love of the sensational; but it promised at least certain tangible profits under circumstances which La Bourdonnais felt assured would yield nothing but loss otherwise. As Britain and France were unmistakably drifting towards war, he requested that the force required to undertake this plan of operations should sail for Mauritius without delay; but the directors of French policy turned a deaf ear to his representations and only one vessel was sent out.

In India the affairs of the French Company were under the control of Joseph Dupleix, who had been appointed Governor General in 1742, the year before the occurrence of the irregular collisions between Britain and France—such as Toulon and Dettingen—that led up to the formal hostilities beginning in 1744 which were afterwards known as the war of the Austrian succession. The oriental policy of Dupleix lay at the opposite extreme to that of La Bourdonnais—whom he detested—for whereas the latter thought of little else than the maritime situation, the former took no heed of it whatever. His judgment therefore lacked a sense of proportion in regard to fundamental issues, although he displayed so remarkable a capacity for statecraft of the sort which is based on a thorough understanding of the oriental temperament that his influence with several of the most powerful Princes in Hindustan practically placed their armies at his disposal. In so far as that assisted him to menace the small British garrisons at such places as Madras, it provided him with a source of power on the spot—poor in quality though abundant of its kind—without drawing on that of France; and with this at his back he aspired to drive the British out of India, and found an empire acknowledging the sovereign authority of the House of Bourbon. But at best this local native support was a totally inadequate substitute for power of the quality represented by European forces even in limited numbers; and as he never looked beyond India, it evidently did not occur to him to consider how France was to exercise authority of any sort over a land from which she might become so totally isolated as to be unable to work on either the

self interest or the fears of its inhabitants while her rivals could do both.

Faulty in their very foundations though they were, however, the grandiose schemes of Dupleix appealed to the directors of the French East India Board as an ultimate ideal, in their ignorance of oceanic strategy; though actually at the moment they were making great efforts to keep Indian affairs outside the scope of a struggle which had become plainly inevitable on the continent of Europe. In this last attitude they had the co-operation of their rivals in London, who were well aware of the unpreparedness of their own Company to take up arms, and feared for Madras and Calcutta. But, just as La Bourdonnais had anticipated, the British government had no intention of subordinating national war plans to private interests by refraining from using the naval superiority which was the most effective weapon in their hands at any point where it could hurt the enemy. War was war to them, and if the King of France chose to attack the interests of England in mid Europe then the French must accept the consequences in all the seas of the world.

When, therefore, war was at last formally declared in 1744—after several violent encounters afloat and ashore in a time of nominal peace—the British Admiralty despatched a division of four vessels to the Indian Ocean under Commodore Barnett, with orders to attack French interests in eastern seas, where they were reported to be undefended by any regular warships. Three of the four were 50-gun ships—that is to say liners of the lowest rate—which by all reasonable calculations was an ample command for the work in prospect: though, if the Admiralty had been acquainted with the character of the Governor of Mauritius, they would probably have increased the squadron to six or eight. But La Bourdonnais was an unknown man, even in Paris, outside a small circle. Arriving in the Indian Ocean shortly before the autumn change of wind, Barnett estimated that his best initial position would be at its eastern gateway, through which the French vessels returning with valuable cargoes from China would be likely to pass in a group some time during the winter or homeward bound monsoon. His expectations

were realised, and all unaware of the British appearance in the Straits of Malacca these heavy laden craft sailed right into his arms. Knowing then that nothing remained to seize in that direction, he sold the prizes to the Dutch at Batavia, and turned to consider the possibilities of attacks on the possessions of the French in India; whose chief trading locality lay on the eastern or Coromandel side, facing the Bay of Bengal, with its centre of administration at Pondicherry. This seaport lay between the British Company's ports of Madras on its north side, and Cuddalore—or Fort St David—on its south; Madras being the British seat of government in southern Hindustan.

In pursuance of this object Barnett left Batavia for the Coromandel coast so as to arrive in the spring; a choice of season imposed on him by the complete absence of a single sheltered harbour anywhere on the east side of the Indian peninsula suitable for large ships, which made the whole coast-line an open and dangerous lee shore for sailing craft throughout the winter monsoon. On anchoring at Madras he found that the originally arranged truce between the Companies was no longer in observance and each was preparing to take the field As the French had much the stronger backing from the native States, Madras was in some danger; but, on the other hand, the French ports were open to sea bombardment and some French ships were loading cargo in Pondicherry roads Barnett's appearance therefore balanced the situation and each side abstained from provoking reprisal by attacking. This condition of equipoise remained undisturbed till the year following, but the Commodore died and was succeeded in temporary command by Captain Peyton, his next senior in the squadron; a nervous and irresolute officer unfitted for the position.

It was at this point that La Bourdonnais appeared on the stage in a manner upsetting all anticipations and arrangements on both sides alike in Europe and the east. After the French directing body had rejected his advice a man of less calibre might have fallen back rebuffed on a routine performance of his duties and left his superiors to go their own way. But La Bourdonnais was incapable of submitting to a passive rôle in war, and, as Paris was far distant, took matters into his own

hands. For the time being fortune was kind to him by placing material at his disposal which a man of energy and determination could use as a makeshift in default of anything better. Barnett's captures of the year before, and the subsequent presence of his squadron—now raised to six sail—on the Indian coast, had held up several large French merchantmen at Mauritius, which had been on outward passage to India and China before these matters were known, and were now lying there awaiting orders. Seven of these La Bourdonnais requisitioned on his own responsibility to form a raiding squadron, with the one ship-of-the-line already at his command as flagship. Like all vessels engaged in eastern trade, they carried a sufficient armament for defence against pirates, for which he partially substituted heavier metal from reserves of ordnance at Mauritius; and at the same time added a large proportion of negro hands obtained from East Africa to the crew of each, so as to leave the white complement entirely free for the guns. It was a scratch fleet at best, with which none but an audacious leader would have ventured to meet regular built fighting ships; but there also fortune was with him, Peyton being his inferior in every quality making for success in war.

Having raised his force, it was for La Bourdonnais to select his first point of attack, and in that his judgment was more open to professional criticism than in anything else he did. No reasonable prospect of obtaining a permanent command of the Indian Ocean presented itself to his choice, for even if he defeated Peyton—which cannot have seemed likely—overwhelming enemy reinforcements were certain to arrive out before the war ended. At best, therefore, the time at his disposal was limited, and the degree of his possible success exactly proportionate to the period devoted to laying hands on valuable and easily-seized British property. Under such conditions he was doubtless right in not going out of his way to find Peyton and fight him for a temporary and problematical supremacy which might very well cost him so dear in the acquisition as to cripple him beyond the power to undertake his real object. But he was wrong on the next point, or at least so it will seem to most students of naval warfare. Two alternatives lay before him. He

could begin by attacking enemy property afloat, here to-day and gone to-morrow; and follow that up by threatening land positions which could not run away in the meanwhile. That was Barnett's method. Or he could reverse the process; which in point of fact he did, and thereby only won a half success. His extemporised squadron was ready for work by the spring; a season giving him indeed a fair wind to India, but just the time of year when the British freighters outward bound for Bombay and Calcutta were coming round the Cape. Had he followed Barnett's example of setting a trap for traffic certain to be entering the Indian Ocean by a fixed route at the very moment, and proceeded with the raiding of seaports afterwards, he would have increased the losses he inflicted on the British Company immensely, at certainly no additional risk to himself. But on leaving Mauritius he made Madras his first objective; with the result that all these ships not only reached their several destinations, but loaded up and sailed for home again at the change of season.

If his decision was questionably sound in itself, however, he carried it through with a superb audacity, displaying no hesitation to meet a British force, which under proper leadership ought to have been more than a match for his own heterogeneous and semi-trained command. And here again luck favoured his enterprising spirit beyond expectation On arriving in the Bay of Bengal he ran into the British division almost at once, and an action ensued in which, without any reasonable justification, Peyton did his utmost to get beyond range from the outset, and eventually retired from the scene practically undamaged. Because neither side suffered appreciable loss this encounter has been described by some writers as indecisive. But it was far from indecisive in its consequences nevertheless, for it gave La Bourdonnais the measure of his opponent, and removed all doubt that he might proceed to attack any British position he chose on that side of India without serious fear of interruption. The British transmitting cable of national energy had in fact been cut. It is true that Peyton hove in sight again a few days later, but contented himself with sailing about at a safe distance and then disappearing finally. When this futile demonstration

had passed off without result La Bourdonnais anchored unhindered in Pondicherry roadstead, and notified his intention of attacking the British seat of government in that part of India to his compatriot Dupleix. Jealousy prevented the latter from aiding, but the admiral persisted in the project and successfully compelled the surrender of Madras after a brief investment by land and sea. Thenceforward the different views of these two high officials were accentuated. La Bourdonnais held the seaport as spoil of war, and now Dupleix wanted to absorb it in his visionary Franco-Indian empire, having done nothing himself to take it. But the naval officer frankly disbelieved in the possibility of such a dream ever materialising in the face of British sea power, and resolved to make the most of his prize in the only practicable fashion Madras might not be carried away, but could be reduced to ashes in a day unless the residents made it worth his while to stay his hand. A businesslike parley on these lines ended therefore in his acceptance of a ransom of about double the monetary value of the entire squadron that extracted it. When this deal had been concluded La Bourdonnais returned to Pondicherry, having first, to the furious annoyance of Dupleix, pledged the honour of France that Madras should remain free from further molestation.

Everything attempted by the French admiral so far had passed off successfully. For the moment he commanded the Indian Ocean and could proceed to attack British interests at any point therein he pleased unhindered by human opposition. Nothing was known as yet in England of his activities, and for a whole year no reinforcements came out to join the British squadron. In that time, if disaster had not overtaken him in a form against which he was powerless, he would have conducted, beyond any reasonable doubt, one of the most sensational cruises in history; for with the approaching turn of monsoon, the British ports in western India lay open to the same form of treatment as Madras, and the Dutch ports in Ceylon as well; Holland being another enemy of France. La Bourdonnais had in fact planned to utilise the tail end of the summer monsoon to carry him to an attack on the Dutch stations in Sumatra when Madras was liberated. But now fortune suddenly deserted

him, and the forces of nature came to British assistance as so often in history. The Bay of Bengal happens to be one of the four general sea areas of the world subject to the devastating visitation of revolving storms; and in that particular region they occur towards the end of the summer monsoon, the only season in which, as already remarked, operations on a large scale were practicable to sailing fleets in the same locality. Belligerent forces engaged in conflict in the Bay of Bengal were like hostile armies facing each other in an earthquake area, where both may be impartially swallowed up without warning; and it was just when La Bourdonnais was on the point of starting for Sumatra that one of these hurricanes smote his squadron, bringing his schemes to ruin by totally wrecking three of his best ships with all hands, and dismasting the remainder. Any hopes of further success were now shattered, and his crippled surviving hulks had no option but to crawl back to Mauritius, whence, at the instigation of Dupleix, the admiral was recalled next year to France and imprisoned for serving his country according to his lights, dying a broken man. If his character and war plans are taken into consideration, and the absence of any effective check on his movements, this cyclone has some claim to rank as one of the most notable incidents of Indian Ocean history. And it is no more than a just tribute from his former opponents to the memory of a fine seaman and gallant officer that his statue should still overlook the Indian Ocean from the seaport which he created and whence he sailed to spread dismay among the enemies of France, though that seaport now lies under the flag of those same adversaries.

Only a few days after the final departure of La Bourdonnais from the Bay of Bengal, the French Governor General, aided by a native Prince, cancelled his treaty, seized Madras, and compromised the honour of his country; the pledge of the French admiral having been given under the discretionary power of a King's officer to decide an important point in war without reference to higher sanction when the circumstances make such a reference impracticable. With Madras thus in the hands of Dupleix, the British Company's staff and forces had no fortified rallying point left on that side of India except Cuddalore,

which Dupleix prepared to besiege with the help of the Nabob of the Carnatic next year, that is to say, in 1747. But other events intervened and great transformations in the world situation were occurring. By the wreck of the ships under La Bourdonnais, and the supersession of Peyton by Admiral Griffin, who arrived a few months afterwards with two additional vessels to reinforce the British division, the far end of the British line of power transmission was restored. Results were soon apparent. Both combatants were getting exhausted in India more or less; but the British had the smaller reserve of energy on the spot, and their need for a fresh supply of Imperial force was greater than that of their adversaries. It was fortunate for them, therefore, that Griffin's appearance on the coast happened to coincide with the French move against Cuddalore, and caused Dupleix to retire to await a more favourable chance that never came. From that stage the rôles of attack and defence began to change hands. Scarcely had the far end of the British line been re-connected when the home end of the French was so decisively broken that it remained inoperative for the rest of the war. Six powerful vessels sailed from France, with orders to join the now refitted remnant of La Bourdonnais' former command lying disengaged at Mauritius, and then move on as a whole to destroy the force under Griffin. When French supremacy had thus been reasserted in the Bay of Bengal they were to co-operate with Dupleix in sweeping the British Company clean out of southern India, for which purpose they carried French troops. These six started with a large fleet and convoy bound for America, to travel together till clear of European waters; but another fleet specially despatched under Anson broke up the whole combination in the Bay of Biscay, and not one of the ships destined for the Indian Ocean went further than three days' sail from home, four surrendering to Anson and the other pair being chased back. After two years of conflict, British superiority in the main theatre of operations was now at length producing the decisive effect in far distant areas which La Bourdonnais had foretold.

This effect steadily gathered weight. With the return of the summer monsoon in 1748 the British resumed the offensive

in eastern seas begun by Barnett but interrupted by La Bourdonnais. A fleet of ten sail arrived in the Bay of Bengal from England under Boscawen; which, in conjunction with those already on the station, made up by far the most powerful force ever assembled outside the North Atlantic up to that date. It was superfluously strong for the requirements of the naval situation, but the easier position in Europe enabled the British government to spare the ships from home service, and their numbers permitted the conveyance of enough British troops to reverse the whole state of affairs in the Carnatic by passing from defence to attack. The British power line was now in full working order. As no sea enemy required Boscawen's attention, he lost little time in commencing operations against the heart of the French possessions, and encircled Pondicherry on all sides; but, though that well-fortified colonial capital was to fall into British hands eventually, the time was not yet. This first siege entailed such heavy losses to the attackers on the land side through mismanagement and disease that Boscawen broke it off, and re-embarked the surviving troops in time for the fleet to leave the bay and sail round to Bombay before the winter monsoon made re-embarkation impossible: but not until a hurricane of the same kind as that which had ended the cruise of La Bourdonnais a year before took its toll of the British in their turn and caused the loss of some of their best ships and men. The attack would undoubtedly have been resumed next season nevertheless, if Britain and France had not already arranged a treaty of peace—unknown, of course, in India till many months later—while the investment of Pondicherry was actually in progress. Among its other clauses this treaty of Aix-la-Chapelle provided for the restitution of Madras to the British Company in exchange for a similar handing back of Louisbourg in North America to the French Crown; a seaport captured during the war, to which the French attached a strategic value not at all shared by British naval opinion. That this exchange was decidedly in favour of England can hardly be denied if the two places be compared as they stand to-day; and the hauling down of the Bourbon colours over so great a prize as Madras when no enemy was in sight much mystified the

natives of southern India, to the detriment of French prestige.

The close of five years of strife between these two great Powers, therefore, left the territory of their respective Companies in the east exactly as it stood before; and, if the map of India had been the sole gauge for measuring the results of the contest on that side of the world, it would have lacked historical interest as a stalemate leading nowhere. In reality it was far otherwise. For the first time British national forces were engaged in waters where only privately employed British forces had been in action before; and the despatch of Barnett and Boscawen to the Indian Ocean marked an immense widening of the direct pressure applied by British sea power against the interests of a European opponent. Moreover, it signified official recognition of the claims of British commercial enterprise in distant regions to State support when endangered by European rivals in arms. The flag was here following trade, in accordance with the general tendency in British foreign expansion, and not *vice versa*, as some political economists would have us believe.

Equally important was the effect produced by the war on the views of the directors of the French Company. Like the Londoners, the merchants of Paris and Bordeaux had originally speculated in eastern ventures purely as buyers and sellers on business; and the visionary suggestions of founding a great Franco-Indian Empire poured into their ears by Dupleix only sounded attractive as a possible preliminary to the establishment of a colossal monopoly. This hope sustained them to some extent during four years of complete cessation of trade; begun by the alarm caused through Barnett's captures, continued by the diversion of freighters to fighting purposes by La Bourdonnais, and prolonged to the end by Boscawen's overwhelming strength in eastern seas But when the French line of power transmission was severed by Anson the prospects of a great empire in the east were obviously receding; and as a first direct consequence of the rupture of their only transport route to the Carnatic came the inevitable abandonment of the plan of Dupleix to annex Cuddalore. Then followed the inversion of

the whole military position in the disputed region, when Dupleix was compelled to stand on the defensive himself and submit to the complete isolation of the Company's own seat of eastern administration; which, though failing to enforce its surrender at the time, proved the insecurity of Pondicherry against the possible repetition of such attacks. And, lastly, came the blow of the order to the Company to evacuate Madras, on the retention of which great anticipations were founded as an outlet for the commerce of a large area through a long established trading connection. All these lessons and disappointments were emphasized by the knowledge that the business of their British rivals in Bengal and western India had flourished throughout the war, in spite of occasional losses by privateer captures; for even when La Bourdonnais was a terror on the Madras side, the south-west monsoon kept him to leeward of the Indian peninsula while Bombay harbour was full of ships loading for home, beyond his reach till they could slip away.

With such experiences to discuss, some of the more influential French shareholders were beginning to lose faith in the schemes of Dupleix, even before the war terminated; but he himself remained blind to the real situation, and when peace was restored associated himself more than ever with the intrigues of the native States in such a way as to embarrass the policy of the British at every turn. This compelled the latter to form alliances with the native rulers who were in opposition to his supporters; and in that way many encounters took place between the troops of the two Companies as partisans of warring Indian potentates, though the Companies themselves were at nominal peace with each other. As the spheres of these irregular conflicts widened their expense increased, and to all demands on the part of the Board in Paris for more parcels of Indian goods the militant Governor General replied by asking for more soldiers and ammunition. At the same time, however, he managed to send home enough in the way of marketable freights to keep them just appeased for so long that it was not till 1754 that they lost all further patience and ordered him home. He died in destitution and obscurity, like his victim La Bourdonnais.

When Dupleix was recalled, peace between Britain and

France had lasted for six years. But as the treaty of Aix-la-Chapelle was little more than an armistice caused by general exhaustion, many of the minor points in dispute had remained unsettled and a fresh war was already imminent. During 1755 several collisions were provoked on either side, and in May 1756 Britain issued the formal declaration of hostilities which launched the memorable Seven Years' War, whereby Anglo-Saxons were raised to heights of power never approached in their former history.

In the earlier part of this celebrated conflict British statesmen failed in some respects to make full use of the naval superiority at their disposal, though certain precautionary steps were taken. Among these was the despatch of a squadron to the Indian Ocean under Admiral Watson in 1755, when the political outlook was becoming seriously disturbed. Watson's command included four sail of the line, and carried troops under Colonel Clive for use as might be necessary in defence of the British Company's territories against either French or native invasion. For a time this naval and military combination acted as an amphibious flying column. As no French fleet required his attention the British Admiral held straight for India, and as the near approach of the winter monsoon denied him any possibility of visiting the east side for five months he made Bombay his first destination. Thence, after a brief stay, he proceeded with Clive's help to begin work by extirpating the Angria pirates. At the change of monsoon in the spring of 1756 he sailed round to Madras with Clive and his men still on board. His appearance thus in the near neighbourhood of Pondicherry, at a time when intelligence of the outbreak of war between France and England was daily expected, secured the safety of the British ports on that side of Hindustan; but while lying in Madras roads he was informed of the seizure of Calcutta by the Nawab of Bengal. This placed Watson in an anxious position. Clive urged the admiral to carry him and his troops up the Hooghly without delay to recapture the Bengal capital; but Watson's principal duty was to prevent the arrival of any enemy in India by sea, and such a contingency had to be regarded as among the possible consequences of the expected war with

France. British naval commanders were well aware that, at peril of Court martial, the Admiralty expected them to ensure that there should be no recurrence of such incidents as La Bourdonnais' capture of Madras; and if he pushed himself up one of the most difficult rivers in the world to navigate, in the largest ships that had so far entered it, he might suffer accidents reducing his force in the process, and in any case could not get back to the Coromandel coast for some time if needed. Few admirals would have set aside these considerations at once to meet Clive's suggestions. Some might have declined the responsibility altogether. Watson took the middle course and accepted the risk of leaving Madras exposed after a careful review of the position, for Clive's army was impotent to remedy the indisputably disastrous state of the Company's affairs in Bengal without his help to take it there. He agreed, therefore, to make the move; and so enabled Clive to recapture Calcutta and defeat the Nawab on the famous field of Plassey, at odds almost as great as those faced by Albuquerque's squadron at Ormuz. Some of his ships assisted also in the taking of the French capital in Bengal at Chandernagore on the Hooghly, which was their last direct co-operation with Clive. Soon afterwards Watson died, and was thus denied the opportunity of meeting the French in the Bay of Bengal; which fell to his successor, Admiral Pocock; a fearless and energetic commander but a mediocre tactician.

War with France had been declared in the meanwhile, and the British situation in the east was so far satisfactory that the Anglo-Indian line of communication was well guarded at both ends. But on the other hand, the ministry failed to cut the corresponding line of the French by any blockade of their ports, such as Pitt instituted when he came into power at a later stage of hostilities. Through the absence of any such check a French squadron of six sail left Brest for the Indian Ocean in 1757—the year of Plassey—under Commodore D'Aché, carrying troops for Indian service under the Irish Count Lally. On both sides, therefore, the conveying lines of national power were working in competition. Clive's position having been consolidated on the Hooghly, the fleet left the river to meet the

GEORGE POCOCK

British Vice-Admiral and Commander-in-Chief in the Indian Ocean

(By permission, from the portrait in the National Portrait Gallery)

new danger; and D'Aché, with three extra vessels picked up at Mauritius, entered the Bay of Bengal in the summer monsoon of 1758, where Pocock was already on the watch. In this second Anglo-French series of encounters the better commander was on board the British and not the French flagship; but as the difference between him and his opponent was not so pronounced as between La Bourdonnais and Peyton, success was more fluctuating and the fighting much more severe. The British had seven vessels, the French nine, but of individually less force. In the opening moves the combatants passed each other unseen at night, the British admiral hunting to the southward for the enemy and the French making northward to attack Cuddalore. Pocock soon searched back up the coast, however, and, finding the French hastily getting under way from Cuddalore roads, fell on them forthwith. This was the first of a succession of battles, each in turn the bloodiest ever fought in the Indian Ocean up to the date of its occurrence. The British attack was delivered in line abreast from windward against the parallel French formation in line ahead, according to the conventional and unscientific practice of the day. But it was faultily executed, and D'Aché struck back with such vigour, that although eventually forced to retreat in disorder, he saved all his ships and crippled his enemy too much for pursuit. By that the French gained a somewhat important point, apart from the immediate avoidance of loss in vessels; for it was imperative for Pocock to recondition his command for service with the utmost expedition, and as the necessary repairing material was only in store at Madras, he was obliged to abandon Cuddalore temporarily to its fate, which fell before a land siege by Lally in direct consequence.

After the fleets had drawn apart, each made for its nearest refitting port at the best speed its damages would permit—the British to Madras and the French to Pondicherry—under the double urgency of being ready to meet either the enemy or the weather, as the cyclone season was at hand. Pocock was soon refitted again by strenuous effort, but for a time remained at Madras, which was weakly garrisoned and expecting attack by Lally's army. Finding, however, that the French general was

making no move, he sailed once more in search of D'Aché, whom he met and attacked a second time. Except that the losses in men were even heavier, this round was in all its features and results a repetition of the first; the same determined onset, the same wholesale bloodshed, the same retreat by the French, the same futile effort at pursuit by the dismasted British. But Pocock's persistence was beginning to tell; for all the French repairing stores at Pondicherry had been used up to make good the damages after the first action, and now D'Aché was compelled to retreat the whole way to Mauritius to obtain a further supply, without which he was helpless to fight again. For thus leaving the Indian coast some writers have criticised the French admiral, and Lally complained bitterly of the withdrawal. But as the absolutely essential refitting equipment was exhausted in India D'Aché could in truth have done nothing else. Pocock had the advantage there, and could soon be ready for further encounters, which the French ships were in no condition to face. At Mauritius the French commander knew that at the worst he could not be brought to action for some time after arrival, even if followed when his enemy was again ready for service.

It happened, however, that Mauritius had deteriorated greatly as a naval base since the recall of La Bourdonnais ten years before, through a lack of understanding of the administrative requirements of sea warfare on the part of the French; and here it is pertinent to observe, as an important and instructive circumstance connected with the whole subject, that, although the British Company were often inferior to their French rivals in military preparations, they were always much better in naval, except in the time of La Bourdonnais. At this point of history the Bombay yard could build or dock even a seventy-four; and its reserves of equipment were ample and good. But at Mauritius every kind of supply was deficient, even to provisions; so that only by dismantling his worst damaged ships entirely and using their gear for the others was it possible for D'Aché to restore any to a serviceable state; and even the repaired ships had to be sent on several months' absence to the Cape of Good Hope for victuals, a point as far distant from Mauritius in one direction as India was in the other. Thus,

though reinforced by three liners from home, he did not return to the Bay of Bengal till late in the summer of 1759.

During this twelve months' interval in the active operations Pocock also left the Coromandel side for the winter monsoon period, and sailed round to Bombay, where his squadron was thoroughly overhauled after its two years of strenuous service. In his unavoidable absence Madras was besieged by Lally, but managed to hold out till Pocock's return caused the French to retire. That retreat marked the turn of events, which now, as in the previous war, ran in British favour with increasing momentum till the end. Clive predicted such an outcome even when Madras was under siege, in a letter written home to Pitt; in which he expressed confidence that though British prospects might appear bad, the French would have lost everything in India by the end of the year, through shortage of war supplies from external sources as long as the British squadron commanded the Bay of Bengal; while the Madras army could make good all the wastage of war from overseas. Thus the current of national energy through the French line was cut off and threatened with total exhaustion, the British supply well assured and growing in volume steadily.

Once more, however,—though now for the last time—Pocock had to fight to maintain that situation. D'Aché reappeared in the Bay of Bengal in the late summer with eleven sail; but as his original vessels had only been indifferently refitted, and his losses in men could only be replaced by natives from East Africa, the fibre of his numerically powerful command was feeble. Pocock had no more than nine ships under his orders, but all in excellent condition and British manned throughout, having been completed to full crews by hands entered from merchantmen at Bombay. The result was inevitable. A small replenishment in troops and munitions carried by the French for Lally did succeed in landing at Pondicherry before the British intervened, though too few to affect the military situation. But almost immediately afterwards Pocock again caught their fleet at sea and forced a third pitched battle, in which the carnage on the French decks was so devastating that D'Aché lost any remaining hope of ultimate success; knowing that the

combatant value of his command deteriorated progressively after every engagement through irreplaceable loss of the right kind of men and material, while that of his opponent could always re-enter the arena as dangerous as ever. He decided therefore to retire while his ships were still sufficiently seaworthy to escape from irretrievable disaster in a contest where no prospects of victory remained, and sailed for Mauritius and France. Lally protested against his departure, knowing nothing of the nature of a seaman's responsibilities, and it has sometimes been held that D'Aché might have done more. He was certainly not in the same class of war leaders as the two other French commanders of Indian Ocean history, La Bourdonnais and Suffren; for, unlike them, he remained content with defensive tactics, and never attempted to gain a command of the sea theatre of operations. But though shamefully starved by the home authorities, he did nevertheless twice thrust himself into an area where he was certain to be attacked, in order to support his comrades on the land Thus, if he made no effort to sever the British power line, he still endeavoured under great handicaps to maintain the French; and his detractors are not the men of his own profession, who can appreciate the immense difficulties with which he had to contend.

By a vigorous and sustained offensive, which eventually drove the enemy's flag from eastern seas, Pocock had finally cut the French line at the distant end while keeping his own intact; and in this same year 1759 it was also severed near the home terminal by Hawke's great triumph at Quiberon, which shattered the French navy beyond recovery till long after the return of peace. The complete isolation of the Carnatic possessions of the French Company thereby brought about ruined their last ambitions in India, where Lally's situation went steadily from bad to worse, as Clive had foretold. Half the white troops originally sent out with the Franco-Irish commander had already been lost through war and disease, most of his munitions had been used up, and all his money was spent. No replenishments of any kind could reach him from France. But all the requirements of war on the British side could be met—and were more than met—through the transmitting

cable of national force. Colonel Coote was carried to Madras with British regulars, where he at once moved to attack on the field, defeated Lally at Wandewash, and captured or recaptured all the positions held or taken by the French, beginning at Arcot and ending at Pondicherry, with the fall of which Lally and the remnant of his army surrendered. The French flag had now disappeared from India as utterly as from the Indian Ocean, and not a shred of its authority remained for the time. Pondicherry was returned to France at the end of the war, but its fortifications had been levelled and its trade was gone. Lally subsequently fell a victim to the mortification and disappointment of the French Board of Directors; at whose suit he was executed for not saving an impossible situation, for which they themselves had been responsible through lack of understanding.

The white man's dominion over the Indian Ocean—first established by the Portuguese, and for many generations the foundation of all contact between east and west—had lasted for about two centuries and a half when it came to Britain's turn to hold it as a result of the Seven Years' War. In British hands it has remained ever since, except for one brief lapse. That dominion is of course only a means to an end, but in the absence of any alternative means essential to the attainment of that end. The end itself is the application of British energy to vast fields of labour and enterprise, to which the command of the sea ensures that the energy shall be safely transmitted if threatened by hostile action. By acquiring an unchallenged command of the Indian Ocean as a first step, Britain was able not only to proceed with great developments in India but to use India as an advanced base for further overseas conquests; or as a secondary power house for the storage and distribution of national force received from the mother country. Hence, in following up the course of subsequent history, we find that in later wars every one of the more important possessions of her enemies lying in or adjacent to the Indian Ocean was attacked and taken by expeditions crossing it from India as a starting point. The Philippine Islands, Java, Malacca, Ceylon and Mauritius all fell into British hands sooner or later in that way, though many were ransomed or returned to their former owners

on the restoration of peace. These conquests were in fact initiated even before the Seven Years' War concluded. In that war Spain eventually took the side of France, whereupon a squadron sailed from India for Manilla under Admiral Cornish —Pocock's successor—conveying troops commanded by General Draper. This combination captured the Philippine capital and a large Spanish treasure ship with gold from Peru. The treasure ship and her freight were prize of war, and Manilla was ransomed after the example set by La Bourdonnais at Madras. In all the booty amounted to £1,400,000. Since the attack on the Portuguese at Ormuz in the very early days of the London East India Company one hundred and forty years before, this seizure of Manilla was the first blow struck at an enemy fortress colony by a British sea expedition launched from India. It was a fore-runner of many others undertaken in later wars as a consequence of British sea power in the east; the latest being the subjugation of German East Africa one hundred and fifty-five years after.

XIII

The LAST BATTLEFLEET STRUGGLE in the BAY OF BENGAL

It has often occurred during the long process of the expansion of the British Empire that a state of war on its land frontiers in Asia and Africa has been contemporary with a state of complete peace at sea; and in this co-existence of strife on one element with calm on another the operation of cause and effect may be discerned without much difficulty. Hostilities on the water entail an uncertainty in the transmission of Imperial energy to distant parts of application on the land, and work at those points has to be planned or undertaken on a correspondingly reduced scale. But peace on the water secures to them an uninterrupted and unthreatened flow of power, enabling the Imperial workers on the spot to overcome local opposition, whether active and mobile in character, or merely passive and inert. Thus we find that the fifteen years interval of peace among the maritime Powers which came between the second and third of the great ocean wars of the eighteenth century coincided with one of the most turbulent periods in the contact of Europeans and Asiatics on the soil of Hindustan.

When the two principal white nations holding territory and interests in that land ceased to strike at each other in 1763, the victorious British were liberated to march against any native enemy with an assured line of reinforcement and supply at their backs reaching all the way to Europe. Thus supported from the main generating station of national power, they pushed far inland during the next decade from their fringe of coastal settlements, and brought wide areas of thickly populated territory under their control, either directly, or through native rulers acting as their instruments. This penetration, however, went further in Bengal than in Western or Southern India. On the Bombay side the Mahratta chiefs proved formidable neighbours, while in the Carnatic region the brilliant soldier upstart Hyder Ali usurped the Sultanate of Mysore, and became a source of frequent anxiety to Madras. Under such conditions the line of least resistance in moving towards new areas of trade lay up

the banks of the Ganges; and when, after leading separate existences since their establishment, the three Presidencies of the British East India Company were united in 1773 under Warren Hastings as first Governor General, his seat of administration as such was left at Calcutta, where he was already President, though Bengal was the youngest of the Presidencies, and from a naval or military standpoint Calcutta was an incomparably worse headquarters position than Bombay.

During this same fifteen years of European peace and Indian warfare the fleets maintained by Western Powers in eastern seas dwindled to very small proportions. Even when the possessions of the dissolved and bankrupt French East India Company were transferred to the French Crown in 1769, they were left almost destitute of immediate naval protection; and though the Dutch Company had yet another generation of decaying existence to run, ships of the State Navy of Holland practically disappeared from Asiatic waters, where the only naval forces left under the Dutch colours were a few small coastguard sloops. Even the British Royal Navy was only represented by one liner of the lowest rate, and three or four cruisers; supported by an equal number of the light armed vessels belonging to the British Company. But insignificant though the European squadrons might be, they were sufficiently a reminder of far greater powers in reserve to prevent any Asiatic challenge to the white man's dominion over the Indian Ocean, or any recrudescence of piracy on the scale which prevailed during the first half of the century. An effort of Hyder Ali to establish a coastal flotilla on the model of the earlier but now defunct Angria sea forces did indeed occur, but was suppressed at one blow; and though minor piratical disorders occasionally broke out at remoter points, such as the Persian Gulf or Malayan channels, none of these were of a nature to cause alarming dislocation to peaceable sea traffic.

Matters were in this condition of maritime tranquillity when the whole scene was suddenly changed by the action of France in attacking England in 1778, ostensibly in support of the revolted American colonies but actually in the hope of profiting by British national emergencies. In this new conflict the French

king adopted the policy of striking at the most distant extremities of the British realms rather than threatening an invasion of the heart, as in the last war; and in the interval of peace the French navy had been considerably strengthened and reorganised. But through the consequences of the preceding war French power had fallen so low in Hindustan that their small garrison stood no chance of holding its own against the army of the British Company, and having no prospects, therefore, of setting up an Indian Empire of their own, their plan was to help the native Princes to make such an empire equally impracticable for England.

As events on the Atlantic occupied the whole energies of the French navy for a long time after the war began, however, this problem of intervention in the East was not seriously taken up till the addition of Spain and Holland to the muster of the anti-British nations pointed 5000 more guns at England. When France drew the sword in 1778 her navy could only count 75 sail-of-the-line to the British 130—excluding about a dozen others past service—and in India the military odds were so greatly in British favour that Warren Hastings had merely to order the seizure of Pondicherry for that place to be occupied after a brief resistance, and a skirmish in the roadstead between the small British and French squadrons stationed in the Indian Ocean, which ended in the flight of the latter to Mauritius. But next year, when Spain joined France, 60 liners were added to the fleets arrayed against England, and the potential scope of major operations was extended to the furthest limits of British rule east and west. As that important change in the strategic situation necessitated an immediate and considerable re-disposition of forces, the British and French Governments both despatched a squadron of the line to the Indian Ocean, neither being aware of this action on the part of the other at the time. Six British vessels sailed for Bombay under Sir Edward Hughes and six French for Mauritius under Count D'Orves. Neither side, therefore, secured the dominant position on the far side of the Cape of Good Hope at which both had aimed; and for more than a year each admiral felt too uncertain of his prospects of success to risk an attack on the other.

While the fleets were kept in this attitude of mutual watching and waiting the troops of the British Company in India completed the capture of the French positions, by seizing their last remaining settlement of Mahé, on the Malabar site of the peninsula. Though only a minor station its fall produced highly important consequences by bringing the redoubtable Sultan of Mysore definitely into alliance with the French. For some time previously Hyder's relations with the British had been fairly amicable; but on his part it was a truce of expediency only, and when he learnt that England was entangled in formidable difficulties in Europe and America he saw what he conceived to be a promising chance for a forward move against British possessions in his neighbourhood. Mahé lay near enough to his own territory to make its enforced change of ownership a pretext for war, to which a successful issue seemed to be guaranteed by a French pledge to assist with a strong brigade of white troops specially sent out from home On the French admirals, therefore, fell the responsibility of ensuring that these troops were duly landed in India, on the British admirals the responsibility of preventing it.

Before any contact had been established, however, between the Sultan of Mysore and his French comrades in arms, the general British situation was rendered graver than ever by the accession of yet another navy to the great combination already formed to encompass the eternal downfall of the British nation. Holland joined it with 26 more ships-of-the-line, raising thereby the number of heavy vessels which the British fleet was called on to withstand to 160; and thus for the first time in a hundred years that fleet took the sea in war with fewer ships than its antagonists. Had the latter now worked properly together, overwhelming disaster must inevitably have overtaken the realms under the Union flag. But so defective was their collaboration that in spite of great advantages in numbers and position they failed either to overthrow British resistance in European waters, or to prevent the despatch of reinforcements to the hard pressed extremities of England's 20,000 mile line of defensive activity. Four more liners were ordered out to join Hughes and in due course arrived at Madras.

Almost simultaneously with that movement the French despatched five liners to join D'Orves at Mauritius, and under their protection a large fleet of transports carrying regiments and guns for service in conjunction with Hyder Ali; the whole convoy sailing under Commodore Suffren, whose heroic figure now appeared on the stage of eastern history. While these reinforcements were making the nine months' outward passage, D'Orves paid a flying and futile visit to the Bay of Bengal during the winter monsoon—calculating correctly that Hughes would then be on the other side of the Indian peninsula—and communicated with Hyder, who was halted before Cuddalore, impatiently awaiting the French admiral's help to take it. But D'Orves was so daunted by the lee shores and surf-swept beaches of the season that he returned to Mauritius, leaving the irritated Sultan to withdraw again to his hills. With the coming of the south-west monsoon in spring Hughes sailed back to the Bay of Bengal and embarked British Company's troops at Madras to seize the Dutch Company's ports in southern India; the loss of which was the first consequence to Holland on that side of the world of her entry into the war. Such a result the Dutch had probably foreseen, hoping at the same time with some reason, that the ruin of Britain which the autocrats of France and Spain were now confidently anticipating—in common with their allies of British ancestry and anti-autocratic principles in America—would put everything right in due course. Having missed his chance of meeting and engaging the French fleet under favourable circumstances through his absence at Bombay, Hughes remained on the Madras side when the winter monsoon again returned, in spite of the risks attendant on exposed anchorages, open coast and onshore winds; and even transported an attacking body of troops from Madras for the seizure of the fortified and strategically valuable Dutch harbour of Trincomalee in Ceylon, the only anchorage anywhere on the west side of the Bay of Bengal affording sheltered accommodation for a fleet at all seasons of the year. Here he captured a large number of Dutch merchantmen, which had made for that port for safety on the outbreak of war.

By this time the four liners from home had joined up, and

brought the news that the large convoy of French troopships for India, escorted by a battle squadron, was well on its way out, having indeed fought an indecisive action with the British reinforcing vessels *en route*, at the Cape de Verde Islands. As soon as Trincomalee had been captured, therefore, Hughes went straight back to Madras, to replenish magazines in preparation for big emergencies. It was well for him that he did. D'Orves was not a venturesome officer, but to do him justice, lost little time in starting from Mauritius to Hyder Ali's help after Suffren had joined his flag with the extra ships and transports from France. He was already far on his way towards India while Hughes was still assisting in the capture of Trincomalee.

It was at this critical stage of a rapidly developing situation that an event of the highest consequence occurred. The French admiral was in failing health, and on the 9th February when nearing the scene of action succumbed to climatic disease, being succeeded as Commander-in-Chief by Suffren, whose dominant genius for war put a new complexion on everything, and doubled the menace confronting Hughes and his military colleagues in the Carnatic. Sir Edward was an officer of the not uncommon type, in which a selfless courage and sense of duty are handicapped by an imperfect understanding of war as an art; and though a tenacious fighter his grip was unequal to that of his untiring and far abler opponent. Suffren had all the best qualities of Hughes on a higher plane, combined with the intellectual grasp of main issues and readiness of initiative which produce a commander of the first rank. He was far ahead of the doctrines of the French navy in matters of general sea strategy, and through never being afraid to take his own line, perplexed the British by introducing a factor of a novel kind in their experience of dealing with French fleets. Thus in the third of the Anglo-French sea campaigns in the Indian Ocean—as in the first—the better leader served under the colours of France. But in all three the British leader handled the weapon of finer proved temper. In seven of the nine general actions fought from first to last—counting the meeting of La Bourdonnais and Peyton as one—the French fleet was the larger. In

PIERRE-ANDRE DE SUFFREN SAINT-TROPEZ

French Rear-Admiral and Commander-in-Chief in the Indian Ocean

From a painting by A Roslin permission of "The Connoisseur"

six of the nine it was certainly commanded by the better admiral. But with everything in French favour when actually engaged, the British officers and men saved the situation again and again by superior valour, discipline and seamanship. The British line of battle was a definite fighting formation whether for attack or defence. The French ships seemed incapable of maintaining any formation at all till the very last action was fought and the war practically over. The British *morale* seemed to harden and improve under the strain, but the French *morale* deteriorated till Suffren had made a drastic weeding out. If supported as well as Hughes he would have carried everything before him from the first engagement, whereas in the end his mission was not fully accomplished till after five pitched battles.

In the highly important but often unappreciated matter of fleet maintenance on distant war service—seldom really understood in France—the British Admiral had also the great advantage of an ample reserve of guns, ammunition, timber, spars, canvas, rope, provisions and water, all close to the scene at Madras; besides the support of batteries on shore when he anchored there to refit, or draw ammunition after action. Having lost Pondicherry already the French had no such repairing base nearer than Mauritius, a month's voyage distant: though even Pondicherry had never been the equal in that respect of Madras. But as Suffren could carry large quantities of spare powder and stores in the troopships under his escort, and could moreover obtain provisions and water from his Dutch allies in Ceylon, the lack of an advanced base was not enough to prevent a man of his determined vigour from holding the situation in spite of stubborn opposition. At the same time the acquisition of some sheltered anchorage wherein to pass the next winter monsoon, instead of returning to Mauritius and abandoning the Bay of Bengal to the enemy, was so prospectively urgent that it occupied a very important place in his programme. Trincomalee was incomparably the best, but it was in British hands. He decided, therefore, that Trincomalee must be recaptured in due course, and in his scheme of operations aimed firstly at demolishing Hughes to clear the way for

everything else; then at landing the army to assist Hyder Ali in overthrowing the British in India; and then seizing Trincomalee and using it as a base for a fleet commanding all sea approaches to India till the end of the war. Such a plan, if successful, would have isolated the British garrisons indefinitely from relief, and encouraged their native enemies throughout the peninsula. In Suffren every naval officer must recognise the artist.

The nine ships-of-the-line lying in Madras Roads under Hughes when the French fleet reached the Bay of Bengal were the first and most formidable obstacle with which Suffren had to deal. By pure good fortune he had already met and captured a tenth on passage to join her consorts who badly needed her. With a prize crew placed on board—which his strongly manned fleet could easily spare—this gave Suffren the appreciable superiority of twelve liners to nine instead of the bare margin of eleven to ten. Some fifteen or twenty transports sailed under his escort, and thus about thirty vessels were visible on the horizon through Hughes' telescope on the morning of February 15th when Suffren appeared in sight of the Presidency capital. Being necessarily still in ignorance of the death of D'Orves the British Admiral supposed him to be in command, and was not apprehensive of any bold or immediate attack; but the number of sail in view enforced caution, and if compelled to engage he hoped to do so with the support of the batteries on shore. He drew his blade, so to speak, and stood on the alert by clearing for action, heaving short on his cables and watching for the enemy's next move. That move was rather what might have been expected from a man of D'Orves' irresolute character, for when the approaching French fleet had reconnoitred Madras and the offing for a day or two, it turned southward again and headed in the direction of Ceylon. In reality this was a trap of Suffren's to draw Hughes from the support of the batteries, and it proved quite successful. He calculated rightly that the British Commander would be alarmed for the safety of the still weakly garrisoned prize of Trincomalee; and indeed it is noticeable all through the long struggle which followed, how clearly the opponents read each

other's minds when Hughes had learnt what manner of adversary he had to contend with. When he saw the direction in which the enemy was now steering, Hughes' anchors were up in a trice, and he gave chase in the full belief that he was after D'Orves. He was even fortunate enough to capture some of the French troop transports separated from protection by bad management in the night. But for two whole days Suffren continued the pretence of running away till the British fleet was lured off far from its base; a trick that Hughes himself employed on a later occasion. Then he suddenly turned on it and struck his blow on February 17th, hoping that with his superior numbers one straight fight would give him final victory.

But now the French admiral was to suffer his first experience of disloyal and incompetent subordinates. So negligently and clumsily were the vessels of his rear division handled that his line went to pieces, and the attack resolved itself into a chaotic encounter of unequal brunt in both fleets, which was prolonged without decisive result till the fall of the black tropical night broke it up. As some of the British ships were too seriously damaged for immediate further service, however, Hughes felt a withdrawal was imperative, and slipped away under cover of darkness for Trincomalee, which was much nearer now than Madras. This baulked Suffren from a fresh attack next morning, and so far not one of his enemy's vessels had been sunk or captured. But on the other hand they were at least temporarily thrust aside, and he knew that he might return to the Coromandel coast and land the army to assist Hyder Ali without much risk of being attacked in force during the laborious and delicate operation of disembarking thousands of soldiers from open sea on an open beach. For the time, therefore, he postponed a search for Hughes, and sailing north, put the troops and camp equipment successfully on shore to form contact with the Sultan's army; a junction of forces which soon brought about the long delayed fall of Cuddalore. That important part of his mission was thus accomplished; but until the British fleet had been finally put out of action by destruction or capture, the sea maintenance of campaigning supplies for the brigades in the

field necessarily remained a constant source of anxiety to the French admiral.

While Suffren was thus employed Hughes was pushing forward his repairs at Trincomalee, and within a fortnight his fleet was again ready for action. He knew nothing definitely of the whereabouts of the French fleet since the battle, but feared that he was too late to obstruct or threaten the disembarkation of the French army, and could only operate thenceforward by cutting its line of communication. Foreseeing, however, that Suffren might be looking round for a base in case of a prolonged struggle and would probably cast his eye on Trincomalee, the British commander resolved as his next immediate occupation to make that port stronger by bringing some more guns and troops thither from Madras if it could be managed. Such a move was obviously dependent on being kept secret from Suffren, who happened to be lying between Madras and Trincomalee in an excellent position to intercept sea communication between the two, though still mystified as to the whereabouts of the British fleet since its disappearance on the night of action. Hughes took the risk, sailed from Trincomalee, kept out of sight of land on the passage and arrived undetected by the enemy at Madras, where the military authorities at once agreed that Trincomalee must be strengthened, and put the necessary troops and guns on board At this juncture, by a timely stroke of good fortune, the British fleet was increased by two more ships-of-the-line arriving from home, which just managed to escape report by Suffren's scouts. But intelligence reached the French admiral through native spies of Hughes' arrival at Madras, so that when the latter again left for Trincomalee he encountered Suffren at sea and a second general action ensued on April 12th. Leaving out tactical details this second fight was merely a repetition of the first in its main points and consequences. So carelessly did some of the French captains obey signals that all organised movement attempted by their leader was faultily executed to a degree rendering the official reports of the engagement widely discrepant from opposite sides. The French impact, however, fell mainly on the British centre, where it produced a confused but

terrific *mêlée*, in which several vessels—including both flagships—suffered a fearful list of casualties and others were dangerously disabled; while those further out received little injury.

But before any clear advantage had been won on either side both found themselves threatened by a danger of another kind. The battle began near the north coast of Ceylon, and in grappling with each other the fleets had drifted so close to shoals as to be in perilous proximity for the crippled ships, which, by compelling the admirals to yield to the exigencies of navigation, forced them to disengage and draw apart beyond range before dark. At sunset both had anchored in open sea, out of shot but within sight of each other, where for several days they lay laboriously re-conditioning their battered gear, like exhausted pugilists in opposite corners of a ring. The British had fared worst in injuries to masts and the French in men, but both were in a shaky plight and could count themselves fortunate that it was too early in the year for cyclones.

Suffren's spars having suffered least he was first recovered, and got under weigh, but to the great surprise of Hughes did not at the moment renew the fight. For this abstention, however, the French admiral has left his reasons on record. His ships were running short of ammunition, and the twice proved inefficiency of his captains was causing him such qualms that even so intrepid a chief was not prepared to take the risk of engaging under any disadvantage. He foresaw now that the vanquishing of Hughes was going to be a long and strenuous task; though perhaps hardly anticipated that it would occasion as many as three more general actions, of which two were destined to come near to French defeats. The necessity for filling up magazines on every opportunity had become pressing, and as a convoy of transports with additional ranks for the army and general supplies for the fleet was already due from Mauritius he went south to meet it at the allied Dutch harbour of Galle, leaving Hughes alone for the time. At this *rendezvous* he completed up with all kinds of war necessaries and then escorted the troopships on to the Indian coast to land their military drafts; seeing nothing of Hughes on the way, who, when he found that Suffren was not re-engaging at once, had taken the

chance to move into Trincomalee to put ashore the reinforcements for the garrison embarked at Madras before the battle, and also to complete in a sheltered port the very extensive refit required by his worst damaged ships. This last occupation kept him there for several weeks; but when at length ready for sea, he sailed again to try and prevent Suffren's further communication with Hyder Ali, meeting the French fleet near Cuddalore and forcing a third fleet action on the 6th July. All the eleven liners of his command were present, but of the twelve under Suffren's flag one had been disabled through bad handling in a squall. For the first time, therefore, the fleets were numerically equal, and for the first and only time it was the British who attacked.

At the outset everything pointed to a British success. Hughes was not a tactician of the order of Rodney, Hood or Nelson, but in devotion and skill his officers were second to none and his ships sailed into action in a well kept line very unlike the straggling mob of the French. Once engaged on a properly distributed line of targets their superior gunnery soon began to tell. But it seemed to be ordained that this series of battles was in every case to be rendered barren of decisive results by the intervention of external factors. This time the weather conditions robbed the British of a victory that seemed otherwise almost certain, for the French were losing men at nearly three times the greater rate. It was an afternoon of light and variable winds, and when the action was at its height from van to rear and going in British favour everywhere, a sudden shift of the breeze to right ahead cleft the contending lines apart on opposite tacks, and having separated then beyond effective range left them as suddenly becalmed and unable to resume action before dark. Among the British casualties was Hughes' second flag captain killed at his side, whose predecessor had fallen in the first battle.

During the night the wind sprang up again and both fleets made for the land to get rid of wounded and obtain more ammunition, Hughes steering for Madras, and Suffren for Cuddalore, which he used as a war anchorage after its capture from the British. Here he heard that a second convoy of troop

transports was shortly due at Ceylon, and as the action of Hughes in forcing the third battle suggested that he was determined to take the offensive when numbers were equal, the French admiral deemed it his first duty at the moment to protect this convoy in force when entering the theatre of operations. Sailing south from Cuddalore therefore he met it on the coast of Ceylon, where the two liners forming the escort on the ocean passage joined his battlefleet and raised it to fourteen sail. A similar movement in the direction of Ceylon in the opening stage of the conflict had drawn Hughes after it in anxiety for Trincomalee, as we have seen. But this time he was more dilatory—in the belief that the enlarged garrison was able to defend the fortress—and delayed following the French till priceless days had been lost. When at length, therefore, he did proceed to discover what was passing he suffered the mortifying blow of finding that he was too late. Trincomalee was in Suffren's hands, and this consolidated the French position to such a degree as to alter the whole prospect in India.

On meeting the convoy Suffren had reached the vicinity of Trincomalee with fourteen sail-of-the-line, and several transports carrying troops which his discretionary power enabled him to divert for any specially important purpose. Hughes was apparently nowhere near. Having therefore, an exceptionally favourable opportunity for grasping the prize which he always intended to acquire sooner or later, he delivered an attack by land and sea whereby it was forced to surrender. Hughes had failed in everything now except in saving his own fleet from destruction. The French army had been landed in India and kept supplied. The French fleet had seized for its own use the only first class natural base in the immediate theatre of war.

But in spite of these failures the constant proximity of an undiminished enemy fleet threw a perpetual strain on the vigilance of the French commander, as a potential menace to transports and disembarkations; and this anxiety tended to increase. He feared that Hughes might at any time be strongly reinforced from home before he could be defeated; a well-grounded apprehension, for six more British liners happened to be eastward bound to join the British admiral already. And

he knew that large additional bodies of troops were due to start for India from France, whose numbers would add to the difficulty of conveying them to the field in face of active sea opposition. When therefore the British fleet appeared outside Trincomalee again on September 3rd, he promptly sailed out with his fourteen ships to attack once more. Hughes now copied his opponent's former tactics of drawing the enemy far from his base before fighting, in a fashion that stands as the finest bit of seamanship in the whole conflict, and one which evoked the candid admiration of Suffren himself. Keeping his fleet well together he ran to leeward all day in a zigzag retreat which only a thoroughly trained force could have executed, and by frequent changes of course scattered his unseamanlike pursuers far and wide. Then he turned and faced the leading group which included the French flagship. In his impatience to close while daylight lasted Suffren attacked without waiting for the rest to come up; and so staggered was his disorderly crowd of sails by the British counterblows that if Hughes had been a Nelson he would have profited by their utter confusion to double on them to windward and gain a fine victory, as French officers themselves have pointed out. That, however, he failed to do, nor was he a commander of the high type only satisfied with the perfection of success. Having shattered the onslaught of an enemy holding every advantage of numbers and windward position, he remained content with breaking off the action at nightfall and steering away for Madras; leaving Suffren dismasted in open ocean with the cyclone season on him, and unable to follow. This fourth battle was the worst French failure of all. It took Suffren a week to get back to Trincomalee with his crippled ships; and in his disappointed exasperation he very properly at last removed from command all those of his captains who had consistently proved unfit for their responsibilities.

Hughes had thus defeated all the attempts of a numerically more powerful fleet to accomplish his destruction, even if he had done nothing else. But subsequent events proved that his fine defence in the fourth battle was the effort of a tired man, and his outlook for the more immediate

SIR EDWARD HUGHES

British Vice-Admiral and Commander-in-Chief in the Indian Ocean

By permission, from the picture by Reynolds in the Painted Hall at Greenwich

future was difficult. Summer had passed, and the loss of Trincomalee caused him serious uneasiness with the change of seasonal winds in near prospect. A year and a half of war service including four general actions had left his ships in poor condition to face the steady blast of the north-east monsoon for months together on an open coast and permanent lee shore. Hulls were patched and leaky, upper gear mostly a makeshift. Half his captains had been killed. All the repairing outfit at Madras was used up, and Suffren was well placed to prevent any more reaching him from Bombay. His enemy's fleet, though as dilapidated as his own, enjoyed a perfect shelter for the coming monsoon, and the assurance of ample refitting supplies by safe routes, not only from Mauritius but Batavia. As for Suffren himself his powers were rising higher than ever; and if the strain of responsibility was bearing heavily on the British admiral, his French opponent was one of those rare characters on whom it acts as a positive tonic. As may be seen from portraits both were men of very corpulent physique, but whereas the handicap which that imposes on long sustained exertion in a hot climate affected Hughes, it diminished the vigour of Suffren not one atom

Hughes, however, had at least the satisfaction of knowing that if the coming monsoon compelled his war-worn fleet to evacuate the Bay of Bengal, it would also prevent any large reinforcements or campaigning supplies from being landed for the enemy army before the early part of the following year, and since taking Cuddalore they had made little headway on shore. This consideration, together with the state of his ships, practically decided him to withdraw to Bombay for the winter, though postponing his departure to the last moment. Events however over which he had no control precipitated the movement; for before the change of monsoon actually occurred his fleet was struck in Madras roads and completely dispersed by one of the shattering cyclones which were the constant dread of sailing fleets in the Bay of Bengal during the summer months. When one of these hurricanes was abroad nothing else much mattered, and though its effects were less severe to the southward Suffren remained within the landlocked shelter of

Trincomalee doubtless commiserating his enemies as brother seamen, but hoping that for the sake of France it would sweep them out of existence. Fortunately for Hughes his scattered ships were commanded by men with few professional equals. Not a single vessel was lost, and all found their way independently to Bombay in due course. By this separation of the fleets active hostilities were suspended in eastern seas till the following year, and it would have been better for the reputation of Hughes if he could have retired from command.

At this point attention is necessary to the important progress of events at the home end of the line of communication with India. Here the French authorities had made great preparations for the support of Hyder Ali by organising the despatch of the largest European military force ever up to that date assembled for service in Hindustan. It was embarked in three convoys starting from different points, so as to arrive early in 1783 under the command of the Marquis de Bussy: but two of the three were intercepted and either captured or driven back by the vigilance of the British fleets in Europe, though de Bussy himself got through. Suffren met the one convoy that escaped as it neared Ceylon, and escorted it to the Indian coast, where de Bussy and one brigade were landed as the only representatives of an expected force three times that size. His fleet was joined by the three liners which came out with the convoy; but as he had lost two others by wreck since his last encounter with Hughes his total command was only raised from fourteen to fifteen. Hughes' fleet, on the other hand, was increased by the six from home already mentioned, which brought him up to eighteen all told. During this lull in the naval hostilities Hyder Ali died, and his successor Tippoo was much disheartened by the small scale of the French reinforcements.

With the spring change of monsoon in 1783 Hughes sailed back to Madras, where the non-arrival of French troops in the Carnatic, except the few with de Bussy, had raised the hopes of the British Company's army commanders. Further encouraged by the re-appearance of their naval colleagues in apparently decisive strength they resolved to attempt the re-

capture of Cuddalore and marched from Madras accordingly. Cuddalore was besieged on the land side and blockaded by Hughes to seaward. Everything at this juncture, therefore, seemed to promise well from the British standpoint, except for a terrible outbreak of scurvy in the fleet. Hughes' fortitude was sorely tried by this grave misfortune, and the British military offensive produced an almost inevitable crisis in which everything depended on his firmness. Against an ordinary adversary he might have held his own, but Suffren was on the move once more, and Suffren had the same exhausting effect on his enemies as Nelson. When the struggle recommenced against such an antagonist Hughes fought almost like a man resigned to defeat

The French admiral had superseded his incompetent subordinates by successors of his own choice, and was now to show what he could do with proper backing. Even when armed with a blunt weapon he had been dangerous: with a sharp one he became deadly. To Suffren's intense vexation de Bussy had been placed over him by King Louis, and in his alarm at the size of the force under Hughes the French general insisted that the French fleet should remain inside Trincomalee for safety unless a grave emergency arose The encirclement of the French garrison of Cuddalore, however, was regarded by Suffren as quite emergency enough to justify acting with explosive energy when he heard the news. Embarking food and munitions for the besieged troops he hastened northward at once, and by the unhesitating boldness of his approach with only fifteen ships to eighteen, so discomposed Hughes that the latter abandoned the blockade and left Cuddalore open to relief. After landing the supplies for the garrison Suffren followed the British fleet and on June 20th, 1783, in a fifth and last battle attacked so fiercely—and in such good order—that he knocked the British admiral squarely off the stage; who was in retreat by nightfall a beaten man. With the remarkable personal triumph to his credit of having compelled the retirement of a hostile fleet superior to his own in every respect but leadership, the great Frenchman reached the culminating exploit of his career; and when he returned to Cuddalore roadstead after the

battle the British military leaders lost hope of re-taking the place and prepared to raise the siege.

Events, however, on the other side of the world had been moving meanwhile in a direction affecting all theatres of war; and terms of peace had in fact actually been signed in Europe, unknown to the combatants in the far East, five months before Suffren's final defeat of Hughes. Intelligence of this arrived just as the besiegers of Cuddalore were falling back, and brought all operations to a standstill on both sides pending instructions from home. Finding that Britain's position in the Atlantic remained unshaken, her numerous but exhausted antagonists had relinquished the attempt after four years of wrangling effort. By the terms under which all belligerents hoisted the "cease fire" signal to their navies, England retained her oversea possessions intact—excepting the revolted American colonies—whether temporarily occupied by enemy troops, like Cuddalore, or not. Thus, just as the defeats of the main Dutch fleets in the seventeenth century, and the main French fleets in the earlier wars of the eighteenth, had saved the situation of the British Company in India when matters were going against them on the spot, so now they were once again succoured by a renewed assertion of British naval supremacy carrying its consequences far and wide. From the very first days of European intercourse with the East by sea the position in the Indian Ocean had depended as a last sanction on that in the Atlantic. Suffren might have the upper hand of Hughes on the coasts of Hindustan, but what really mattered was that Rodney, Howe and their colleagues nearer home were holding down the admirals of France, Spain and Holland in the west. That being the case, England, before sheathing the sword, was able to impose the condition that any distant possessions seized by European adversaries should be restored to her flag. Together with their official notification of peace, therefore, the French commanders in India received orders to march out of Cuddalore—just as Dupleix had been ordered to evacuate Madras—and return with fleet and army to France. Hughes was ordered by the British Government to send most of his ships back to England to pay off at the same time.

Thus the valiant genius of Suffren gained no lasting benefits for his country, though establishing for himself a place as the greatest of French sea commanders; on which point recognition was very soon forthcoming from the quarter best entitled to extend it. Such was the impression created by his personality and leadership among those whose duty it had been to confront him that they gave rise to an incident without any parallel in naval history; perhaps without any precise parallel anywhere. By chance the homeward bound vessels of both sides met at the Cape of Good Hope on their passage; whereupon the surviving British captains repaired in a body on board the French flagship *Héros* to salute in person a master of their profession, though one who had but recently sailed under enemy colours. It may be possible that naval officers of other nations might have acted similarly, but there is certainly no record that any but British naval officers have actually done such a thing; and Suffren was genuinely surprised and pleased with a compliment of so unique and spontaneous a kind; the more especially as he himself had formed a very high opinion of the skill and efficiency with which those who paid it had handled and fought their ships.

The last scene, therefore, of the Indian Ocean drama in which he played the principal part was fittingly laid on his own quarterdeck; but if the old-fashioned three-cornered British cocked hats which came off at the gangway of the *Héros* were doffed in honour of one who had been a formidable opponent to the country which their wearers served, it may perhaps be claimed that in the change of circumstances the act did some honour to that country itself.

From the hour when the fleet under Suffren rounded the Cape of Good Hope in obedience to orders of recall, and entered the Atlantic homeward bound for France, down to the present day, British naval representation in the Indian Ocean has always been effectively superior to that of any country with which Britain has been at war; and at no point in the long stretches of British territory washed by its surf has the flag of any European rival ever been hoisted since the French colours were struck over Cuddalore in 1783.

Colossal encounters have occurred in that long interval, embroiling Britain with all the leading military Powers of Europe in turn, as well as many of the lesser. Only a single decade of Anglo-French peace intervened indeed between the day when the growling thunder of Suffren's broadsides last shook the Carnatic shore and the beginning of another Anglo-French conflict, destined to endure with merely a couple of brief pauses for twenty-two years before the ending at Waterloo. In the mid-nineteenth century Britain found herself at war with Russia and in our own time became involved in the most terrific general struggle that ever convulsed mankind. But never, in the most searching of these trials of strength, has France, Russia, Spain, Germany, Austro-Hungary, Holland, Denmark or Turkey proved competent to vanquish the British navy, or even able to spare a fleet for undertaking major operations against British sea forces in any quarter of the world beyond the Atlantic. Throughout the long tale of strife, therefore, in which Britain has participated since 1783, the activities of her opponents in the Indian Ocean have been limited to the subsidiary form of sporadic commerce snatching; an indecisive method of attack quite distinct from organised commercial blockade, the latest example being the cruise of the *Emden*. Thus not only have the British land possessions in the east been free from danger on their seaward side since the mastheads of Suffren's line-of-battle disappeared below the horizon, but free from any attack on their land side by troops despatched from Europe. Napoleon has been credited with designs on India, but neither he himself nor any of his very numerous biographers has ever attempted to explain how he meant to proceed after reaching Suez. His one movement towards oriental conquest ended in irretrievable failure merely through having to cross the Mediterranean; a trivial adventure in comparison with the deep-water voyage on the far side of Africa.

XIV

PAST CONSEQUENCES and PRESENT CONDITIONS of BRITISH SUPREMACY in the INDIAN OCEAN

SINCE first fairly established, British supremacy in the one hundred and forty thousand square miles of water which lie between Asia, Africa, the Malay Archipelago and the tropic of Capricorn has remained unshaken through peace and war to our own times; and in concluding this general survey of the main history of that immense expanse since the days when it first became a region of international importance, some reference would seem in place as to the consequences of five generations of British domination therein. "What," it may be asked, "has been the attitude of England towards the maritime interests of the coloured millions inhabiting the shores of the Indian Ocean, and what towards the other white nations who stand conspicuous in its commercial and political retrospect?"

The best answer to such questions is to be found in a series of historical facts regarding which there is no room for dispute. In the absence of any publicly announced general policy we must look to performances to discover guiding principles, and in her deeds if not her words the principles which guided England's actions on that side of the globe are plain enough, and in the main consistent. She began by suppressing barbarism and disorder on the sea, and then by degrees effected an extension of human intercourse on a scale unprecedented in oriental history. If it had been possible to foretell the results to the native races, of the British rise to commanding power in the Indian Ocean, such a prediction would have held forth the promise of an era in which, through no effort or sacrifice of their own, they would sail it north, south, east or west in perfect security; but an era in which from that very condition they themselves would be prohibited from regarding the sea as a place outside the law, where the stronger might rob, murder, or enslave the weaker without being called to account. The legitimate trader would enjoy opportunities for amassing wealth to an extent inconceivable to his forefathers, but

the pirate would find a halter awaiting his misdeeds, and the purveyor of live humanity would lose both ship and freight.

Again, a forecast of the consequences of the British command of the Indian Ocean to the interests of rival European States in the East, might very properly have pointed out as a preliminary that the London Company of Merchants had traded to the northern coasts of the Indian Ocean before either the Dutch or French, and thereby established a moral priority of claim. It would then have proceeded to warn them that as both had striven hard to turn the British out they were destined to suffer the fate of the aggressor by being permanently reduced to insignificance on the northern side themselves. The Indian Peninsula with its immediately adjacent continental territory and islands would remain the special sphere of British eastern enterprise, wherein no competition would be tolerated, but in view of the long Portuguese alliance with England no British hand would be raised against the Portuguese possessions even in India. And except on the north side of the Indian Ocean British oriental policy would aim at no monopoly of possession of the kind which fired the ambitions of Portugal, Holland and France in earlier periods. As far as British aspirations were concerned each European State with an established historical position in the Indian Ocean might remain undisturbed in its own original sphere of influence—even if temporarily ejected when at war with England—unless making strategic use of that position to injure British interests. Each might also expand within its own original sphere without encountering British opposition.

A glance at a few prominent facts will show how completely such prophecies would have been verified by actual British proceedings during the last one hundred and forty years. For instance, if the case of the natives indigenous to the coasts of the Indian Ocean be taken first, it will be found that under the maritime supremacy of England the expansion of facilities for commercial intercourse directly profitable to the lands they inhabit can only be described as gigantic. Where one ton of cargo passed in or out of those countries taken as a whole when the British reign of power began, three hundred tons pass now; all

of which means a proportionately increased production of regional wealth. On that point a momentary inspection of one of the trade charts periodically compiled by a special department of the British Admiralty is more illuminating than days spent in the study of published statistics. These charts indicate the known or closely estimated positions on certain dates throughout the world of all British vessels above a small tonnage which were then at sea. For adequate reasons they are kept confidential, but it may be observed without disclosing any official secrets that they show the Indian Ocean as thronged in our own time with a moving swarm of vessels on a maze of routes to which the activity on its surface in the period before British supremacy might be compared to the traffic in Trafalgar Square and that on a highland moor.

Through this enormous extension of water conveyance whole new industries have sprung up in the countries surrounding the Indian Ocean, whereby millions of natives have found new methods of livelihood irrespective of the flag under which they happen to be governed. Such are the great cotton, grain, jute and tea exports from Hindustan, the coffee, rubber, sugar and tobacco exports from the Dutch Indies; and others far too many to enumerate here. But for such a development of industry it was essential that Britain should hold the naval supremacy not only of the Indian Ocean but of the world; for two-thirds of the great carrying fleet without which it could not exist is British, and could neither have been put afloat itself had England been defeated in her great maritime wars of the past, nor equalled in tonnage by any hypothetical mercantile marine under a rival flag. Such an immense organised sea transport—with all the advantages it brings in its train to humanity in general—is dependent on solid and efficient naval protection combined with capital wealth for its creation, and a national sea instinct with good home ports for its administration and manning. As the Dutch lack both the capital and the home ports while the French lack national maritime aptitude, neither could have filled the great place now occupied by England as a mercantile shipping Power, even if the battlefleets of either had exterminated the British Navy as a first step. And

with the sea-carrying capacity of the world in general correspondingly reduced, the growth of the commercial industry to which it has given rise must have been stunted in proportion all round the Indian Ocean as well as in other lands.

The advantages of this supremacy to the native races round the Indian Ocean are by no means confined, however, to increased markets for the fruits of their home labours. Hundreds of thousands have been afforded the chance to seek for new and better homes elsewhere; and that opening has caused redistributions of population on a considerable scale, which are still in process; some of which indeed have produced problems directly affecting the white man's own welfare, though others raise no difficulties. As an example of the last-mentioned may be instanced the peopling by harmless fishing communities of whole stretches of seaboard formerly rendered almost uninhabitable by pirates. But the most noticeable movement has been the crossing of the sea by Asiatics to territories under the British flag in Africa, America and Oceania. Before the days when oceanic travel under the British colours gave assurance of safety, no Asiatic mass emigration had been possible within the period of authentically recorded history, and the enormous population of Hindustan had no outlet. Since the British Peace has been established in the Indian Ocean, however, crowds of Indian natives have found opportunities for subsistence in the British parts of Africa and tropical America; to which lands they have been conveyed with all the rights of British subjects under facilities and securities which they themselves had done nothing whatever to earn. This migration may conceivably attain such proportions at some future period as to become the most colossal of the many results of the safe and easy transit of the Indian Ocean, by populating the uncleared lowlands of tropical Africa with an agricultural stock drawn from congested regions in Asia well suited to the climate.

But no such mass transfer of native humanity could ever be conducted peaceably except under European control; for the undying mutual enmity of the coloured races must inevitably breed violent strife between brown and black in the event of

any wholesale industrial invasion of Africa by Asiatics, unless the impartial justice of strong white rule exists in the regions of disembarkation. Of this the history of Arab rule in East Africa affords ample proof.

Expediency, therefore, is emphatically in favour of leaving absolute power to the white man in these undeveloped territories for the sake of the brown and black races themselves; while equity cannot in reason deny his right to such power in view of the sacrifices whereby it originally came into his hands. But these important considerations do not always receive the recognition to which they are fairly entitled, for the native passengers who have been carried to other shores on the white man's back often demand a share in the government of the lands of their selection, lands which knew no settled authority of any kind till the white man had produced order from barbaric chaos after strenuous labour, and which were all but inaccessible to the native of India till England had opened a road by generations of sea effort costing thousands of white lives. Such demands have not been without support in some quarters even in England, which it is only fair to assume must be due to ignorance of eastern history; for no part whatever in the long, costly and dangerous enterprise of making the Indian Ocean safe for the native of India fell on the native himself. Under such conditions a surrender of the white man's moral right to the sole power purchased at great sacrifices by his ancestors would be at once a betrayal of their labours and a negation of elementary justice to his posterity, such as the law would permit in no country in the parallel case of the individual The sole right of the pioneer to the management of the claim he stakes out by priority in clearing the ground is universally acknowledged, even though others may profit afterwards by his risks and his exertions; and in logical fairness the same rights should be recognised as appertaining to the claims purchased by racial effort, whatever plausible arguments to the contrary may be advanced by extremist schools of social doctrine.

Among other results of the establishment of a reign of law and order by British power in the Indian Ocean stands one which has no materialistic aspects and yet permits millions of

Asiatics and Africans to satisfy an aspiration of their lives which otherwise would be difficult and dangerous of attainment. To the followers of the Prophet of Mecca a pilgrimage to his tomb constitutes the supreme religious act of their faith, but for a very large number a portion of it can only be made by sea. In former chapters reference has been made to the subsidy paid by the Mogul Emperors to the British East India Company for the protection of these pilgrims while on the water against the attacks of plunderers who were often Mahomedans themselves. No such form of recompense has been forthcoming from any Moslem Prince for at least a century and a half, and yet this protection has long been so effective that the troubles and the dangers of the devotees only begin when the sea part of their journey is over and they step ashore on sacred soil among their co-religionists. Thus although the symbol of the Cross is offensive to their faith, enormous throngs of Moslems have been implicitly relying for generations on the security provided for the greater part of a purely religious act of travel by the British white ensign; a flag that proclaims the emblem of Christianity more emphatically than any other national or sovereign standard in the world—or even the flag of the Roman Pontiff—since its design consists entirely of a display of the crosses of three Christian Saints.

In extirpating the pirates, England was not of course by any means acting disinterestedly, for in some areas her own shipping suffered quite as much from their ravages as that of other European countries trading to the East, though never so much as that of the natives. But in rooting them out on her own account she benefited all maritime traffic under any flag in those parts; and even if at first her sea police were only concerned in preventing injury to British vessels, their operations were later extended against piracy in general, till even the Muscat Arabs—who molested none but the feebly defended native craft—learnt that such practices must cease altogether. The suppression of the white pirates was practically completed by the third quarter of the 18th century, after which their appearances in the Indian Ocean were rare; but native pirates offered a more complicated problem on account of their com-

parative facilities for escape. In their case the process of systematic extermination began with the Angria clan; the destruction of whose power created a notable impression throughout the oriental seafaring world from the Persian Gulf to the Straits of Malacca, and sounded a far-heard note of warning to other communities of like habits. By the beginning of the 19th century the coasts of India and the main trade routes of the Indian Ocean had been rendered safe enough; but it was not till nearly fifty years later that the pirates of the remoter channels of the Malay Archipelago had been thoroughly combed out. From first to last Britain carried out the task unaided by any European State except for some Dutch action in the neighbourhood of Java.

The suppression of the sea slave trade was a totally different affair, not only from the standpoint of British interests but in its wider general aspects; for whereas the pirate had stood condemned as a criminal of the first magnitude for centuries by the laws of all countries in Europe and America—and some even in Asia—when British cruisers undertook to hunt him down in the Indian Ocean, the business of the slave dealer was considered legitimate everywhere till England took the lead in denouncing it. Nearly all the countries in Europe followed the British example so far as to abolish slavery within their own borders; but in most parts of America except those under European flags it remained legal up to a period well within living memory, and in many Mahomedan countries it remains permissible still. And with the exception of the British Empire not even the States professing anti-slavery principles made any appreciable move towards suppressing the traffic outside their own territories, for which attitude they had their reasons. In proclaiming her intention of preventing the maritime conveyance of stolen human beings England was deliberately violating all world precedents by interfering with a branch of traffic on the High Seas which nowhere entered British territorial waters or injured British material interests, and which was perfectly legal in the countries to which the traffickers belonged, till England brought pressure on their rulers to prohibit it. On any strict point of international custom or law

no world court of justice, had any such a thing existed at the time, could have upheld the British proceedings. Nor was diplomatic persuasion of any use here. Years of argument could never convince Moslems that a custom recognised by their religion might be morally indefensible. Force therefore remained the sole arbiter in this matter, and Britain's only sanction lay in armed strength on a scale enabling her to impose her will on weaker states as she pleased, under no responsibility to any authority but her own national conscience. But most other governments regarded the British national conscience as a highly irrational and illogical tribunal of judgment; especially as in this particular question the very same sections of the British public that were foremost at one moment in demanding the suppression of slavery were precisely those which at others were wont to decry the use of force in anything, or the maintenance of the armed organisations such as navies, whereby alone piracy, slavery, and sea disorder in general can be kept down. Foreign countries therefore were disinclined to bear any active part in this modern crusade, wherein England received no appreciable aid from any other Power, and sometimes experienced indirect but none the less troublesome opposition in quarters where slavery was theoretically condemned; as for example in the refusal of France to allow any dhow or other native craft to be searched if she could produce a French flag or French papers; a protection that was grossly abused. In her attitude towards the slave trade England furnished one of the extremely few cases in history in which any nation has followed the promptings of pure idealism on a matter of external policy far enough to submit to actual sacrifices; though of all people on the earth the British are perhaps the least anxious to claim idealism as a national characteristic.

The seaborne slave traffic from Africa had two great and quite distinct branches, the western and the eastern. Britain attacked both, but it is only the latter with which we are concerned here. In the Indian Ocean the trade was mainly in Arab hands and existed to meet the demands of native purchasers alone; the slaves being embarked at points on the East

African coast at certain seasons of the year for conveyance to the Red Sea or Persian Gulf by a route within sight of shores friendly to the slave dealers all the way. That facilitated escape as a last resort in the event of chase, by running the dhow on the beach, forcing the slaves to jump overboard and driving them inland out of reach of pursuit. For most of the latter half of the 19th century this route was patrolled at every proper season by sloops and gunvessels specially detailed from the British squadron stationed in the Indian Ocean, at the sole expense of the British taxpayer in money and of British officers and men in blood, neither the one nor the other being spent in the defence of any material interest of their own country. As financial considerations limited the number of patrol ships to three in each season, and as that number was insufficient for the adequate watching of 2000 miles of route by the ships themselves, each vessel on reaching her beat sent off from two to four of her boats on detached service with provisions, water and ammunition for six or eight weeks of independent cruising in open ocean. The climatic exposure of the officers and men so employed was naturally extreme, but the system gave good results, and had been applied not only to capturing slavers but at a somewhat earlier period to dealing with Malay pirates. A boat was far less conspicuous and less easily evaded than her parent ship, and could remain concealed behind rocks or headlands on the coast flanking the slave route, or in creeks too small for a ship to enter. Thus in spite of their comparatively insignificant force the boats actually made the majority of the captures; for the mere sight of a handful of armed bluejackets in a cutter or gig seemed enough as a rule to paralyse the wits of the average slavedealing Arab nakoda and all his men[1]. But occasionally a crew of tougher quality than the rest would show fight and fall on the British officer with his six or eight

[1] For example, on being surprised from behind a rocky point a Muscat slaver surrendered after some blustering panic but no actual resistance to the author, when a very junior officer in a boat with five men and no support nearer than another boat a mile down the coast When disarmed, the Arab skipper tried to escape by suddenly jumping overboard and swimming strongly for the shore a ¼ mile distant, but was chased and recaptured from the boat, though not without considerable difficulty.

men who came clambering from their boat up the high side of the dhow at the critical moment when their heads appeared over the bulwarks. In such cases the ensuing scuffles were often very sanguinary affairs in which almost every participant was killed or wounded; and they possess a certain historical interest as the last encounters in the annals of sea-fighting in which the blade bore as prominent a share as the bullet, for though the Arabs generally carried fire-arms, their principal weapon was a long straight two-handed sword. On the whole the general organisation of patrol reduced the number of slaves transported by sea to small dimensions, though a few were smuggled over year by year until the gradual spread of the white man's rule in equatorial Africa stopped the traffic at its sources.

Safety of the seas therefore—through a clean sweep of piracy and slavery—together with a three hundred-fold increase of water transport which promotes material wealth and opens other lands to emigration, have been the first hand and essentially maritime benefits conferred on coloured races by the British Command of the Indian Ocean. Moreover on this command—as part of a world-wide naval ascendancy—ultimately rests the British rule of India, with all which that implies; though any attempt to trace the consequences of that sovereign authority on the welfare of the 300 millions who live under its sway except in their directly maritime aspects would be outside the specific purpose of this book.

We may pass therefore to a further investigation of the second question already answered in a summarised fashion in a previous paragraph; and follow up in more detail the facts connected with British policy towards the other European nations who played important roles on the Indian Ocean stage before the curtain rose on the era of British preponderance. Britain's attitude in this matter has provided one of the chief strands in the fabric of eastern naval and political history since the 18th century—if not indeed the main core—for it has to be remembered that the so-called Indian Ocean is in reality the most European of all the major water-spaces of the globe —not even excluding the Mediterranean—as regards the

sovereignty of its shores and islands. Excepting on a relatively small stretch of coastline in its north-western sector its whole land circuit is planted with an array of European flags, British, Dutch, French, Portuguese, Italian and not long ago, German, from the Cape of Good Hope in the south-west right round to Australia in the south-east. And omitting only those in the Indian Ocean extensions formed by the Red Sea and Persian Gulf, each of the scores of Indian Ocean islands is claimed as part of some European realm, from the 800 miles long Madagascar down to the uninhabited coral dots on the chart which are the home of the sea-bird and the turtle.

Of all these European possessions in the East the chief is India; which strategically speaking stands as an advanced base or station for the storage of British Imperial energy; whence the path has always been clear for the transmission of that energy in striking form against any of the shores or islands mentioned above since the day when a battlefleet hostile to England was last seen east of the Cape of Good Hope. And so complete have been the results of that unfettered liberty of sea movement that when any European State with dependencies in the Indian Ocean has been at war with England during that period, all the more important of those dependencies have actually been seized and occupied by forces despatched from India sooner or later as troops were available.

But in most cases they were restored at the return of peace; sometimes as the price for political advantages in other directions but more often almost as a gift, and nearly always on easy terms for their previous owners. And therein lay the essential difference between the policy of an all-powerful British flag in the Indian Ocean and that of its several predecessors in their respective days of mastery. When Portugal, Holland or France seized the eastern holdings of a rival, whether British or otherwise, they always aimed at permanent retention; but not even the most uncompromising detractor of British methods and ideals can lay that charge against England's eastern policy, excepting in the quarter where her own pioneers led the way. England's position in the Indian Ocean for nearly a century and a half past cannot perhaps be better

illustrated than by applying to it the description of her general world position at the close of the Seven Years' War as given by a very distinguished American historian, who wrote that she "had but to put forth her hand to take what she pleased." This authority added the suggestion that with such an opportunity it was a mistake not to take more than she did; but in world politics the expediency of such a course lies open to doubt. American standards in foreign affairs differ from British, and every Anglophobe with any knowledge of history is perforce embarrassed by the established historical fact that the people who stand as the only generous creditor nation on a grand scale to-day are also descendants of an ancestry who often displayed a similar liberality in their conduct towards others. As regards the Seven Years' War we have the above-quoted testimony of a non-British expert that England refrained from taking all that it lay in her power to take. Such an attitude displayed self-restraint, but it did at least spare her some small degree of effort and possible sacrifice. At the settlement after the French Revolutionary and Napoleonic wars however she went a step further by restoring—under no compulsion—much that had cost sacrifice and effort to acquire. In those wars she did lay her hand on every important enemy possession in or near eastern seas as a legitimate belligerent act, but lifted it again wherever such a voluntary surrender did not seriously jeopardise her own safety in the event of future hostilities; even though these very same enemies had frequently aimed at stamping the British permanently out from the whole East in earlier collisions. Only on the northern side of the Indian Ocean did the British retain for other reasons than that of their own strategic security any of the numerous territorial prizes of war which fell before their victorious arms.

The chief illustration of this is to be seen in the two settlements with the Dutch, after the latter had fought against England twice as allies of France in the wars of the first Republic and first Empire. In the terms of peace granted to Holland on those occasions many Englishmen who were well acquainted with the East protested that England was carrying magnanimity

towards a defeated rival beyond all reasonable bounds. The Dutch East India Company was finally dissolved in 1798 while the first of these two wars was actually in progress, but as the Company's colonies were transferred to the State they remained under the Netherland flag. As the tyrants of the Indian Ocean for the greater part of the 17th century the Hollanders had only been prevented by the firm stand of Cromwell from ruining their British rivals altogether, and in countries where the rising generations are deliberately educated on the memory of real or imaginary wrongs in the past this would have been borne in mind in squaring later accounts But very fortunately for the Dutch such memories are too short-lived in England to produce any lasting influence on public sentiment; and thus it came to pass that when England stood again over an ancient enemy whom she was fighting for a fifth and a sixth time she helped her vanquished opponent to rise twice over by restoring temporarily held Dutch territories on the eastern side of the Indian Ocean as being within the original sphere of Dutch Eastern enterprise.

These restitutions were in effect free gifts. When Holland joined the French Republic in waging war against the British, the latter retaliated in the East by despatching expeditions by sea from India to capture Ceylon, the Molucca Islands, Amboina and other places in the Dutch Indies; while a squadron from England seized the Cape of Good Hope, where a Dutch Colony had long been established as a half way link with Batavia. But when that particular conflict was ended by the Peace of Amiens, all the Dutch Indies were given back except Ceylon, which lay on the northern side of the Indian Ocean in the general quarter of specially British interest. And when the Napoleonic wars followed soon after and Holland was drawn into Buonaparte's anti-British coalition, the same thing happened again. Once more the Dutch possessions in the far East were conquered by over-sea attacks launched from India; and this time the reprisals were extended to include Java itself with the great oriental capital of Batavia, which surrendered after some sharp fighting in 1811, and remained for seven years in British occupation under the brilliant administration

of Stamford Raffles. For a second time, however, the return of peace saw nearly all the captured Dutch territories restored to Holland although Batavia had been systematically used before its seizure as a supply base not only by the Dutch commerce raiders but the French. It must certainly be admitted that the restoration of a windward position so admirably suited in the sailing era for a naval headquarters in the Indian Ocean would have been an inexcusably unwise proceeding from a British point of view if the termination of hostilities had left Holland with a strong fleet. But the sea-greatness of the Dutch—already far-declined before the war—received its deathblow from Duncan at Camperdown with no hope of recovery; for, apart from the lasting impoverishment of Holland to meet the financial exactions of Buonaparte, the Dutch home coasts were too shallow for the constantly increasing size of the standard ship-of-the-line, and on that type of vessel sea power inevitably depended in the end. Thenceforward the horizontal tricolour counted for very little in the maritime politics of the world, and the strategic importance of Batavia under its folds sank to the same level as that to which the Dutch themselves had reduced the strategic importance of Goa. From the standpoint of war both were now the useless appurtenances of an extinct force, though commercially they might still retain a status of some consequence in times of peace.

But one noteworthy exception to this wholesale return of temporarily though legitimately forfeited possessions was essential to the future development of British Eastern trade and the consolidation of the British strategic position in that part of the world. For more than a century the traffic of the British East India Company had overflowed from the Indian Ocean eastward to Canton and back through the Straits of Malacca; on both sides of which channel the Dutch held territory but the British none, though far the greater number of vessels passing through were under the British Company's flag. The immense importance of that waterway alike in peace and war had been recognised by all Powers interested in eastern affairs ever since the instinctive genius of Albuquerque marked it with a red cross on the chart; and for British trade the acqui-

sition of some spot on one side or other of that channel had become a pressing necessity as a general commercial rendezvous and centre for transhipment and exchange. History had also repeatedly proved that in time of war this hole in the wall was of the highest strategic consequence, for here many sea routes were forced to converge. Here it was that the Portuguese had permanently maintained a watching force all through the century of their eastern sea rule, and here that the Dutch opened their thirty-year course of naval conquest in the East by forcibly taking the Portuguese place. Here also the first British squadron ever despatched to prey on French commerce in Asiatic regions began its work, and here the French Admiral Linois—the victor of Algeciras—tried to reverse that process sixty odd years afterwards, but was so deceived by the formidable appearance and resolute bearing of the homeward-bound China fleet of sixteen large British Indiamen under Commodore Dance that he mistook them for fighting ships and retreated at once to Batavia Here lastly Stamford Raffles—an English landsman with a range of maritime vision little inferior to that of even Albuquerque—was constantly scheming to establish a British foothold at the time of the Napoleonic wars and eventually succeeded. Thanks to his persistence the negotiations for the final settlement with Holland in the Indian Ocean, though offering back to the Dutch a whole archipelago of some of the largest islands in the world, entered a claim for a solitary British post on that constantly coveted trade alley way. The city of Malacca itself stands on the mainland side and happened to be one of the few Dutch points of importance which had not been seized by an Indian expedition during the war, because the troops required for the attack of such a completely fortified position were all employed elsewhere. But several of the less strongly defended Dutch harbours on the opposite or Sumatran side of the Straits were captured by minor British naval expeditions; and as a compromise these were given back in exchange for Malacca, so that the Dutch retained the entire Sumatran shore but evacuated the mainland in favour of Britain. A third successive European standard consequently rose over the earliest far eastern outpost of the white man;

and for the first time in history British colours flew at a point flanking this door to the Indian Ocean.

But though the planting of that flag marked a highly significant step in British world expansion, Malacca itself did not satisfy Raffles, who realised that its open roadstead and shallow inner soundings would militate against its suitability for meeting the great increase in traffic through the Straits, which he correctly foresaw as inevitable in the future. He knew that a far finer natural harbour with immense potentialities for development lay not very distant from Malacca on the north side of the entrance to the Straits from the China Sea, near the ancient Malayan city of Singapura; and by permission of the local native chief had already some years previously established a small trading connection there for the East India Company. When therefore the transfer of Malacca to British ownership signified the general acceptance of the policy of extending British influence to the region of the Straits, he arranged for the purchase of the harbour in question with its surrounding land from the native ruler; and here in 1824 founded the great seaport of Singapore, which has since become the focal point of the whole British Imperial position to the eastward of India through a series of events to be presently detailed.

As in the case of the Anglo-Dutch general terms of peace, so in the Anglo-French no attempt was made on the British side to deprive a prostrate opponent in permanence of eastern possessions after the exhausting conflicts with the Republic and Empire; *except* where these had proved useful to the enemy as points from which to deliver direct and serious attacks on British property. All the French trading centres in India were seized by the British Company when war broke out in 1793, and retained under armed occupation throughout the twenty-two years during which hostilities continued with one brief interval. But long before that period had elapsed the British military hold on Hindustan had become much too secure to be in any danger from the small and scattered French communities at such places as Pondicherry and Chandernagore, nor could those places ever be used as bases for a French army sent out from Europe in possible wars of the future, unless in

the event of a general and decisive British defeat by sea. Being thus in themselves no strategic menace, they were handed back to France as the last remaining traces of the brief day of French power in India; even though lying in that particular quarter of the East in which British interests had been pronounced as paramount, that is to say the northern side of the Indian Ocean.

A different policy however was essential to British security when the question came up of the future status of the strategically important islands owned by France near the great sea trade routes to the eastward of Africa, such as Mauritius, Bourbon and the Seychelles. All of these in some degree, but Mauritius especially, were constantly in use throughout these same wars as wasps' nests from which to worry British commerce, and from an early stage in the protracted struggle it became evident that their seizure would go far towards reducing war risks to British shipping in the Indian Ocean. But a first attempt by a squadron of four British frigates on Mauritius was repulsed with such heavy losses as to prove that troops as well as ships were necessary for its capture, and no troops were available for many years owing to the calls on the Army in India for other duties While that state of affairs lasted British Indian trade had to be afforded what protection was possible by convoy and by chasing the French cruisers; but as the number of British cruisers stationed in eastern seas was severely limited by the exigencies of the situation in Europe, neither of these methods gave more than partial security as long as the raiders could run for safe shelters. When therefore a time eventually arrived in which a sufficiency of troops from India could be spared, Mauritius was taken by a combined naval and military force; the Seychelles suffering a like fate soon afterwards. Bourbon was raided, but as in comparison with the others it offered indifferent shelter to commerce destroyers, it was not occupied.

At the return of peace the future destiny of those islands had to receive attention, and considering their war record the verdict went against their restoration to France. Under the circumstances no other decision was indeed compatible with

the insurance of important British interests, for the French, though temporarily crushed like the Dutch, differed from the latter in remaining potentially formidable as a naval Power of the future, through the possession of greater natural advantages in the way of many fine harbours on the home coasts. Nothing short of a culpable blindness to possible eventualities would have surrendered such bases to a flag which might again make use of them; and with the handing back of their possessions in India the French had to remain content. The return of anything was more than they had a moral right to expect after their own record in the days of Dupleix and Lally.

For Portugal the British advance to the premier position among European nations in the East meant the salvation of the last relics of her own. Thanks to a long tradition of good relations with England, the three old Indian coastal cities of Goa, Daman and Diu, which she still retained when the British Company were laying the foundations of a general rule over Hindustan, have never been in danger of absorption under that rule; and its rapid spread since the days of Clive safeguarded those places on their land side against third parties who would certainly have seized them sooner or later. All the other Portuguese possessions on the Indian Ocean except Timor were attacked and captured during the 17th and 18th centuries either by the Dutch or by Asiatics; but the rise of British naval power put a stop to the Dutch conquests, and the rise of British military power put a stop to the native conquests before the last Portuguese flag in India had been hauled down. The same cause saved them from the French; for if a Franco-Indian Empire as planned by Dupleix had materialised, Goa, Daman and Diu would undoubtedly have been swallowed up, through the political antipathy which in the 17th and 18th centuries was almost as constant between Portugal and France as the opposite was constant between Portugal and England.

For a hundred years and more after the Napoleonic wars Britain was under no provocation to invade the possessions of any other European State on the shores of the Indian Ocean; and when that again occurred, the traditional British policy of abstaining from any wholesale annexation of the conquered

enemies' eastern territory was reversed through circumstances over which Britain had only a partial control. This time the adversary was Germany, a comparative new-comer in the East, and the point of attack was German East Africa; a colony which had only existed as such since the latter years of the 19th century, having originated through a German assertion of sovereignty over a portion of the coast to which no European Power had laid claim since the Muscat Arabs had driven out the Portuguese in 1698. Its precise extent had been settled by treaty with England, as being the Power most directly affected by the commercial potentialities of equatorial Africa on that side; and like other European possessions with an Indian Ocean coastline, it fell, when its sovereign State went to war with England, under the assault of a sea-carried force despatched from India. Unlike the great majority however it was not restored when the conflict came to an end but retained under British rule by mandate. Thus it befel that the political deliberations of a victorious European coalition regarding the seaboards of the Indian Ocean, advanced further towards extending a British dominion over those shores than even British policy itself had done in the past, save only on their northern portion.

By ejecting Germany from East Africa the Great War restored in one respect the general situation round the Indian Ocean to the condition in which it stood as far back as the middle Georgian period; for of the five European flags which cover territory washed by its surf those flying over the most extensive areas are precisely the same three as then, that is to say Britain, France and Holland. And they occupy much the same general regions. British rule predominates more widely than ever on the northern side, along a littoral which gradually spread eastward from Hindustan all through the 19th century, till it absorbed Burma and reached the Malay Peninsula. In the northwest corner a British post was established at Aden, so that the span of the position from wing to wing almost exactly coincides with that of the Portuguese in the 16th century, having the naval headquarters in both cases in Malabar. After surviving all its ancient rivals and leaving a name in

history as the most justly famous of the several associations formed at various periods by private merchants, the British East India Company followed the way of the rest, by being dissolved, when its powers and functions were taken over by the Crown. But as the British supremacy of the Indian Ocean had already by that time long been upheld by Crown sea forces that particular change made no difference to the situation in the Indian Ocean itself.

All down the eastern side of that ocean the horizontally-striped tricolour of Holland still covers the chain of great islands which form the outer ring of the archipelago on that side, only broken by a solitary Portuguese link at Timor; and in its southern latitudes the position lost by the French when deprived of Mauritius was regained geographically though not strategically by their annexation of the very large adjacent island of Madagascar in the last quarter of the 19th century. Intrinsically Madagascar is more valuable than Mauritius, but the diversion of the main route between east and west caused by the cutting of the Isthmus of Suez has left the former island too remote from the regions of crowded sea traffic to hold any importance as a base for commerce destroyers comparable to that occupied by Mauritius before the days of the canal. The French themselves apparently failed to realise this, for in Diego Suarez Bay, at the north end of Madagascar, they created the strongest sea fortress under any European flag in the whole East except Vladivostock, at gigantic expense; although such a fortress can answer no purpose except as a commerce destroyers' shelter. Diego Suarez stands in fact as a conspicuous example of money spent in the wrong place; because it is almost impossible to conceive of any war following such a course as to bring Grand Fleets to operate in that quarter of the seas, and a third of the outlay would have provided quite enough local defence to resist the attack of anything short of a first-class naval and military expedition. But French politicians have even less understanding of such matters than British, and when Pelletan, the then Minister of Marine, asked the Chamber of Deputies to vote the estimate, he explained with such eloquence that Diego Suarez would "com-

mand the Indian Ocean" that the francs were forthcoming. And yet only a few years after the armament had been installed, the German cruiser Konigsberg was terrorising the near neighbourhood with impunity till chased up an East African river by British vessels; a practical illustration of the impotence of a fortress without ships to command any blue water area accessible to an enemy from other directions.

Although, however, the general distribution of white sovereignty on the borders of the Indian Ocean stands much as it did a century and a half ago, the problem of maintaining any stable position in the East, and especially of dominating the Indian Ocean itself, has been drastically changed to the disadvantage of all European Powers by the events of the last twenty years. From the days of Vasco da Gama till the end of the Victorian reign all the principal fleets of the world were European and had their metropolitan bases and mobilising centres in Europe; whence it followed that after the white man had raised a trident over the East the decision as to which branch of the white race should hold it was automatically settled in favour of the nation which for the time happened to be supreme in the waters of the west, as previous pages in this book have endeavoured to point out. The championship of the seas of Europe carried with it in fact the effective dominion of all the other oceans, because to reach the other oceans any of the great navies existent during that epoch had to sail from European ports; and in order to control the course of events in distant maritime areas the strongest sea Power in Europe had only to prevent such sailings by watching the ports in question, which lay close to its own. But a profound change in that condition of affairs was brought to pass towards the end of the 19th century by the building of a great ocean-going war fleet in America for the first time in history; which was closely followed by the similar construction of another in Asia for the first time in history also. This diffusion of the several naval headquarters of the world between three continents in place of their former concentration in one exercised a prodigious effect on international politics, as the rise of the United States navy terminated the monopoly of oceanic power held by

Europeans since the first great era of oceanic exploration, and the rise of the Japanese navy terminated the monopoly of oceanic power still in the hands of white men even when the new American fleet had been launched. Through the birth of formidable fleets with their home mobilising ports and sources of supply far removed from Europe, the long established strategic axiom that the rule of the Indian Ocean was inevitably secured by a rule of the Atlantic ceased to stand except as between European States. These new fleets could enter the Indian Ocean without any necessity to navigate European waters at the start, and the newest of all had its headquarters on the opposite side of that ocean altogether.

This centrifugal movement of the world's oceanic power from its region of origin and long monopoly in Europe—where it had first played a part in authentic history as one of the deciding factors in shaping the destinies of some nations at least—was soon followed by its wholesale decline in Europe itself. Of the five first-class navies under European colours at the beginning of the present century only the British retains what may be called oceanic rank; the Russian fleet having been destroyed by the Japanese and the German by its allied enemies, while post-war poverty keeps the French and Italian far below their former order of precedence. Thus of the various national services which are joint inheritors of the superb records and traditions of the European fraternity of the sea, the British alone has still to be reckoned with as a prime factor in world-wide politics; and even that solitary surviving upholder of a great position once equalled or emulated by several of the others during four centuries of human progress has lost its lead outside the waters of its own continent. History offers no parallel to so wide a geographical transfer of armed power on a majestic scale.

The British navy continues to hold the chief place in the Indian Ocean it is true, but the tenure of that ascendancy can no longer be assured merely by holding the naval supremacy in Europe. In the years to come it will depend quite inevitably on special supplementary measures in a totally fresh direction; and if the statesmen whom destiny calls to the helm in England

in the near future are gifted with wisdom and foresight, the completion of those measures will not be indefinitely delayed. Like all defensive precautions they entail a certain expenditure; but the sum involved is small in comparison with the advantages to be gained, and unless the British people are prepared to sanction the outlay the British Empire will depend for its future existence in the form in which the map shows it to-day on the toleration of other Powers rather than on a strength of its own. Moreover certain highly important branches of the commerce which is its absolute life blood will travel under the permanent risk of a blow that would paralyse them past any reasonable hope of recovery; a matter directly affecting the subsistence of millions of men, women and children in the United Kingdom, whose daily bread is earned in export industries.

As regards its present form or fabric the Empire may be roughly divided into an occidental half—including the British Isles—and an oriental; which are held together commercially and strategically by the Imperial lines of communication across the Indian Ocean; the whole being kept in contact with foreign lands throughout the East by the trade routes traversing the same water-space. If those connections are cut, the two halves of the Empire will fall apart as surely as night follows day, and the severance of the commercial arteries will inevitably cause an exhaustion that must gravely weaken the vitality and powers of resistance of both. Only a fleet can apply the axe, but two fleets are in existence now strong enough to make the attempt should occasion arise, neither of which can be blockaded in its home ports like the French and Dutch fleets of old, and both of which could, by an effort, approach the Indian Ocean from its exposed or eastern side.

In this particular case where only a fleet can strike the blow it happens that only a fleet can ward it off, but the parrying force must be provided with adequate facilities for its work if that work is to be effective. The proper watching station for ships covering the Indian Ocean against an enemy arriving from the eastward is at or near the entrances on that side from the China Sea, in other words the vicinity of Singapore. For

lack of any sufficiently equipped base in that region, a British fleet so occupied would fight at present under a burden of disabilities seriously handicapping its efforts and certainly adding heavily to its losses. The creation of a base at Singapore, therefore, arises from a soundly reasoned appreciation of British requirements of supreme consequence; but a section of British public opinion, led by some former Prime Ministers, opposes it nevertheless, and readers of these lines who may have experienced a difficulty in grasping the actual facts of the situation may find it helpful if they are explained in a little more detail here

Firstly then, it must be understood that under the conditions of naval warfare in our own time, a fleet is more dependent than ever before on the assistance of a secure and fully equipped repairing and replenishing harbour close at hand, if it is to be maintained at a proper pitch of efficiency for service. The modern fighting vessel of any description not only wears out rapidly under the strain of belligerent duty but remains constantly exposed to damage under water; which can only be repaired in dock. All her movements, moreover, are absolutely governed by the question of fuel. Unless tank storage for at least 500,000 tons of oil lies actually within its cruising area, a properly constituted war fleet acting on the strategic defensive may be compelled to leave a vital point unguarded at the very moment when its presence there is urgently required. And unless docking accommodation of adequate capacity exists in that same area, any of its ships that may receive serious injury from mine, submarine or underwater shell hit represent a permanent loss of fighting strength to their side while the war lasts; for even if kept afloat they cannot risk an oceanic voyage to reach dock elsewhere.

Such facts have been so well established however by the actual experience of 20th century wars that the opponents of the Singapore project usually attack it on other grounds. Many are honest, others do not scruple to use questions of such national import for the furtherance of party or personal ambitions; but both rely very largely on the contention that a war against either of the only two first-class foreign naval Powers

—the United States and Japan—is so remotely improbable that expenditure on war bases to meet such a contingency cannot be justified. In so large a question as that, however, the views of the Americans and Japanese themselves cannot in reason be ignored; for if it takes two to make a quarrel it also takes two to maintain a peace. What then do the Americans think? Is it the opinion of the official representatives of the huge and heterogeneous mixture of races populating the United States that a war with the British Empire is unlikely? Yes, if we are to judge by their words. But do they consider it so extremely unlikely that no special precautions to meet it are advisable? Emphatically no, if we are to judge by their actions. Most of the public men in the United States are fully aware that such a conflict would hurl the whole economic structure of modern civilisation into the nethermost pit; but their favourite argument that the unfortified state of their Canadian frontier is a proof of their faith in permanent peace, does not in reality carry much weight, simply because no country needs to fortify itself against a neighbour with less than a tenth of its population and a fiftieth of its wealth. As well might Imperial Germany have pointed to its lack of fortresses towards Switzerland or Belgium as demonstrating its own hatred of militarism. If we turn to the situation on the sea, where the Anglo-American balance of power is much more even, we are confronted by ample evidence of a very different American attitude in the enormously strong sea fortifications which have been erected within quite recent times at the Atlantic as well as the Pacific end of the Panama Canal.

Those defences are avowedly designed by Americans to resist the attack of a first-class fleet, though apart from their own, no such fleets exist except the British and Japanese. The batteries at the Pacific end may no doubt be intended as a safeguard against the latter, but not even the most extravagant alarmists in America have ever suggested that the Japanese could attack the Canal in battle-fleet strength from the Atlantic; and if an American officer is asked to explain the object of the array of guns on that side he will answer at once that of course they were placed there with an eye on the British navy. What

other *raison d'être* could first-class forts at the Atlantic end possibly have? The truth is that those hard practical people take up all such questions in a sober business spirit. They see here a matter of insurance in which great national interests can be adequately safeguarded at what is really a low premium against a risk potentially disastrous even if remote, and heartily though they dislike anything in the way of unproductive expenditure, they insure accordingly. Moreover, though to many Americans the hideous idea of yet a third war with the parent branch of the Anglo-Saxon stock would be frankly detestable, they know well enough that in the past Anglo-American disputes have often reached so acrimonious a stage on paper as to bring war almost in sight, and they realise that in a political deadlock the absence of any vulnerable point in their position must inevitably lend weight to their diplomacy.

That element in the British public therefore, which protests that no account need be taken of the United States navy in organising British Imperial defence, can find no warrant for such a view in the actions of responsible United States authorities; and every argument in the case of the Panama Canal applies with at least equal force to the case of Singapore, for the safety of sea communications is a vastly more important matter to the British Empire than to America. Of course if the British navy ever does happen to find itself engaged in defending the Empire against United States attack, the main location of such a tragedy will lie in the Atlantic; but a detached squadron of American cruisers based on the Philippines—of the composition of the German force stationed at Tsingtao under Von Spee in July 1914—would be a very grave danger to the British situation in the East, unless masked by at least an equal force based on Singapore. Von Spee was compelled to retreat across the Pacific because the whole Japanese navy joined in the hunt against him; but the exploits of the *Emden* proved that when the bulk of the British fleet has its hands full in the Atlantic a single small enemy cruiser can inflict wholesale destruction very quickly on British trade in the Indian Ocean, and even compel special measures to be taken for safeguarding its transit by armies.

When considering the factor in the problem represented by the sea forces of Japan the case for the construction of the Singapore base rests on even stronger grounds. All Japanese governments in these times strive hard to maintain a peaceable foreign policy, but occupy the anxious and difficult position of responsible leadership in an overcrowded land denied outlets, with a population already exceeding that of any European country except Russia, and increasing at the rate of nearly five hundred thousand a year. A highly congested, necessitous, and spirited nation such as this, resembles a boiler with no safety valve. It may hold together for some time, but if it does explode, its pent up force will escape by the line of least resistance, and other countries with interests in its neighbourhood are well-advised to make sure beforehand that that line does not point in their own direction when the liberated energy issues from one of the most formidable Powers in the world. Eruptive tendencies of this kind, affording an object lesson, may be seen in their earlier stages of operation in one of the nations of Europe to-day; for the first immediate consequence of the check to the transatlantic emigration of Italians caused by the new quota laws of the United States was to intensify Italian foreign policy in the Mediterranean and regions nearer home. Though Italy is a far smaller and weaker state than the Empire of the Rising Sun, problems born of the heightened rivalry resulting with other Powers through this new turn of affairs have already confronted the Council of the League of Nations—towards which body the pressure of circumstances does not incline Italians to be too subservient—and the directors of foreign policy in countries with near eastern interests foresee the ultimate probability of diplomatic situations that will need steady handling.

Japan also is barred from overflow to America, and like Italy can only find a line of less resistance to expansion by looking towards regions near the motherland; but those are localities with which England ought always to preserve some degree of commercial connection if possible. Should they become a scene of acute diplomatic controversy British interests are less likely to be swamped or ignored if it is obvious

to all whom it may concern that British policy in the East stands on the firm foundation of a secure hold on the Indian Ocean. A fleet alone can give that security, but, as already emphasised, such a fleet must be provided with the requisite accessories at Singapore if it is to do its work properly should occasion arise.

Apart from the definite existence of two great modern navies able to approach the Indian Ocean from the eastward, there is a third factor in the situation too serious to be overlooked altogether, even if much vaguer in character than the others. Stirrings of a racial consciousness among orientals have been in evidence for some years past of which no man can foresee the outcome. It seems plain enough however that their main inspiration lies in a spreading anti-white sentiment, astutely fanned by Bolshevist propaganda and finding its chief expression in the yellow or Mongolian breeds. As yet this is far from assuming the proportions of a palpable menace to the white man's position on that side of the world; but the fact cannot be ignored that some extraordinarily rapid changes on a portentous scale have occurred in the East within living memory. In the youth of the men who are scarcely now middle-aged, the Japanese counted for no more in world politics than the Tibetans or Siamese to-day; and even ten or twelve years before they suddenly hurled the Russians in the dust, any suggestion that they would ever seriously engage a European Power would have been received with universal and genuine ridicule. It can be hardly wise to assume that what has been accomplished by one Asiatic people must always remain impossible to any other; even if for the moment we can see no obvious sign of such an upturn any more than we could see it half a generation before the great Asiatic victories of Tsushima and Mukden. We do know that the anti-white bias is there; and it seems hardly too much to maintain that the sane middle course between unnecessary alarm and sightless neglect lies in reasonable precaution for dealing with its possible manifestation in dangerous forms. A strong position at Singapore —as the gateway to the Far East—is a measure of such a kind.

A few adversaries of the development of Singapore oppose

it from another angle. Freely admitting that the safety of the Empire demands a first-class naval base somewhere on the eastern side of the Indian Ocean they contend nevertheless that it should be in Australia. The Australians themselves, however—who are intensely interested in the whole question—see more clearly, and strongly favour Singapore, because it meets the first essential for a naval base of being in the right position; that is to say, within the operating area of the fleet for the use of which it has been created. A base in Australia would not satisfy this prime qualification, for no fleet invading the Indian Ocean to cut the British links of Empire from the eastward would ever go all the way round by Australia. Steaming distances and other strategic considerations must always compel such an attacker to travel by one or other of the channels emerging from the Malay Archipelago; and money spent on an Australian base as a substitute for Singapore might just as well be tied up in sacks and thrown into the Indian Ocean at once.

Yet another kind of critic of the Singapore project is the ultra-believer in defence by air. In the discussions on Imperial defence which were so frequent before the Great War reference was common to the so-called "blue water school" and now apparently a "blue sky school" has come into existence also. In both schools the extremists are apt to claim rather too much for their own branch of warfare; and certainly those who contend that sea navies have become obsolete altogether are going very fast indeed. Before aircraft can either attack or protect the routes across the Indian Ocean effectively, they must possess the power to remain over enormous stretches of water for weeks at a time *in all weathers*. That means that they must be capable of withstanding not only the steady pressure of the Indian Ocean monsoon, but the furious violence of the Indian Ocean hurricane, which often throws down full grown forest timber as if it was standing hay. No airship has yet been designed that even begins to display such qualities of flight, nor are there any signs that she will appear in the near future. Until she does, the Imperial arteries in the Indian Ocean will be safe from serious menace except in naval form;

and only by a navy can they be adequately shielded while such conditions last. Beyond any question a fleet of aircraft with headquarters at Singapore would be a highly valuable and even necessary adjunct to the battleships using the same base in war; but they could never hold the Straits by themselves, for the simple reason that a hostile battlefleet forcing its way through to the Indian Ocean would only have to wait for a spell of bad weather to pass with impunity unless opposed on the water.

So far as it is humanly possible to look ahead at present therefore, it is only on the water itself that the connections of the British Empire in the Indian Ocean can be either threatened or protected; and the introduction of air warfare does nothing to negative the value to England of a first-class naval base in the proper strategic locality for a naval defensive covering the regions where the supremacy of the white ensign has long been so beneficial to millions.

In the far distant days when a Pope cut the blank chart of the unexplored world into two parts and handed the eastern half to Portugal and the western to Spain, the Kings at Lisbon assumed the designation of "Lords of the Commerce and Navigation of Arabia, Ethiopia, Persia and the Indies" and though not one of them ever set eyes on the brilliant seascapes of the Orient their ships made good that majestic title to the full for their masters all through the 16th century. Their turn has passed. After many changes and vicissitudes British monarchs have long stood in their place. These lay no claim to the titular sea honours of the former occupants of the Portuguese throne, but their squadron on the East Indies station holds a position in no respect inferior to that of the galleons of Manoel the Fortunate; and for a hundred years or more has used it to a much better purpose in furthering the welfare of humanity. Moreover George V has a personal connection with the Indian Ocean shared by no other Crowned Head in history. In his younger days the wearer of the Regalia of the British Empire often donned the oilskin foul weather rig of an arduous profession, and not only has he seen the Indian Ocean, but alone among the holders of sovereign rank

H & D Downey

KING GEORGE THE FIFTH

(By permission)

The only holder of Sovereign Rank who has sailed the Indian Ocean as a professional seaman

past or present has sailed it as a fully qualified and competent sea officer. Nor is his personal connection with it ended in one respect at least, for even though he can never again heave the log as midshipman of the watch, or keep his eye on the weather leech of the main topgallantsail when steering "full and bye" he still signs the commissions of the admirals commanding the premier force in its waters.

If the teachings of past history are any guide to the future it will be helpful to the continued progress of civilisation throughout the eastern hemisphere that the supremacy of that force should long remain effective. All things must have their end, but the end of a thing which has been proved to be good ought never to be hastened by neglect on the part of the nation which alone has the power to preserve it. And here this brief study of a great subject may perhaps be fittingly brought to its own conclusion by quoting the pregnant words of the first European Viceroy of the Indies to his sovereign. Thus wrote Francisco Almeida to Manoel I:

"*Let it be known to your Majesty that if you are strong in ships the commerce of the Indies is yours; and if you are not strong in ships little will avail you any fortress on land.*"